

Frustration-Aggression-Theory Approach Assessment of sea Piracy and Armed Robbery in Nigerian Industrial Trawler Fishery Sub-Sector of the Blue Economy

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ABSTRACT

The study analyzed the economic cost of output losses as a result of death and injury occasioned by maritime piracy and armed robbery in the ocean trawler fishery sub-sector of Nigeria and the global maritime industry; as economic justification and catalyst for public-private-partnership in reversing the trend of frustration induced aggression of piracy, against the maritime industry in the Atlantic coast of West Africa and Nigeria, through investment in human capital development, youth employment, poverty eradication and community development programmes in the coastal communities of Nigeria. It employed historical design approach where secondary data was obtained and analyzed using the Gross Output Model and the empirical probability model to determine the output losses due to death and injuries to human capital occasioned by pirate attacks in the maritime industry. The empirical probabilities of risks of death, injury, kidnap for ransom, assault, missing of crew, hostage taking of crew and threats of death were also determined. An estimation model was developed to estimate output losses due to death, injury, etc; based on the relationship between the empirical probability coefficients of each risk type, the per capital output of the economy and the number of maritime workers exposed to pirate attacks over a given period in any economy. Public-private participation in development of coastal communities, youth employment, poverty eradication and youth entrepreneurial development programmes was recommended as a long-term solution to frustration induced violence of pirate attacks in Nigeria and the Atlantic coast of West Africa.

Keywords

Frustration-aggression, Piracy-and-armed-robbery, Trawler-fishery, Blue-economy.

To cite this article: Nwokedi, T., Odumodu, C. Z., Anyanwu, J. & Dike, D. (2020). Frustration-Aggression-Theory Approach Assessment of sea Piracy and Armed Robbery in Nigerian Industrial Trawler Fishery Sub-Sector of the Blue Economy. *Journal of ETA Maritime Science*, 8(2), 114-132.

To link to this article: <https://dx.doi.org/10.5505/jems.2020.29053>

1. Introduction

The blue economy of Nigeria which depicts her ocean economy is composed of the various ocean economic business variables and resources, constituting sources of revenue and economic livewire of the nation. According to reference [1], coastal governance index scores of world coastal economies put South Africa in the ninth, and Nigeria in the nineteenth place among world's 20 best economies based on the huge potentials of the blue economies of the nations. A study on the contributions of the blue economy of West African States identified crude oil, natural gas (both ocean energy), diamond, gold, fisheries, marine biotechnology, marine tourism, maritime transport and shipping, as major components of the West African blue economy, contributing paramount incomes to the economic prosperity of the region [1]. In Nigeria for example as a dominator of the maritime affairs of West African States, offshore oil and gas exploration and production constitute a major contributor to national income with duties generated from shipping import and export trade constituting the second largest revenue earner to the nation. Other ocean and/or blue economy business variables such as the ocean fishery sub-sector, inland water transport, downstream oil refining, etc. also contribute as economic drivers of the West African state. Results of studies in Nigeria show that the industrial fishery sub-sector, shipping and oil and gas offshore energy sectors of the blue economy contributes aggregate average GDP of 3301001.0633 billion naira per annum to the national output [1]. The study notes that the industrial trawler fishery sub-sector contributes far less than ocean energy and shipping, such that the yield of the ocean economy is skewed in favour of ocean energy and shipping business operations. The evidence suggests that the productivity of the industrial fishery business sub-sector

is dwindling despite huge private sector investments in the sector and the potentials of growth cum enormous economic expectations from the sub-sector.

Recent outcry by Nigerian Industrial Trawler Owners Association (NITOA) lamenting the huge revenue losses faced by the operators occasioned by violent attacks by sea pirates lend support to earlier public opinion that the industrial fishery sub-sector over the years faced the challenges posed by pirate attack against ships in the Atlantic coast of west Africa, more than the shipping and ocean energy sub-sectors. Statistics by [2] and [3] reveal that piracy attacks against fishing vessels in Nigerian domain of the Gulf of Guinea (GOG) is responsible for the decline in the yield and financial losses in the sub-sector and its contribution as major component business operation of the blue economy of Nigeria. See figure below for further insight into the trend of direct financial losses occasioned by piracy and sea robbery attacks on the industrial fishery sector of Nigeria.

While the direct financial losses to the sub-sector are as shown in Figure1 above, the indirect losses occasioned by output losses to the society as a result of injuries and deaths suffered by fishing crew need to be estimated as basis for economic justification to investment in programmes and policies for the fight against piracy

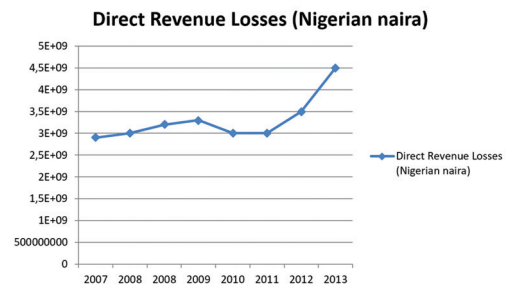


Figure 1: Direct Revenue Losses by the Nigerian Industrial Trawler Fishery Sub-sector Occasioned by Pirate Attacks.

Source: Authors presentation based on NITOA statistics

and sea robbery in the west coast of Africa. See Figure 2 below for the trends of pirate attacks and the associated deaths of fishing crew members in the industrial fishing sub-sector of the Nigerian blue economy.

An inquiry into the phenomenon of piracy in the Atlantic Coast of West Africa, expressed by reference [4] as constituting high level threats of violence and aggression to security in the waters of West Africa, especially in the coastal communities in Nigeria; defining it according to the International Maritime Bureau [5] as “an act of boarding or attempting to board any ship with the apparent intent to commit theft or any other crime and with the intent or capability to use force in the furtherance of that act”. The connotation that piracy and armed robbery against ship denotes both attacks actual or attempted irrespective of the position of the vessel at the point of the attack: at sea, within the coastal or inland waters, within the seaport and anchorages or at dock; support the assertion by public opinion that it is an act of youth aggression, anger and/or violence in the coastal communities in Nigeria and the West African coastal communities, in the drive to illegitimately and forcefully benefit from the profitable maritime business operations in their communities; but for which they have the general perception that they have benefited little or nothing from. Its explanation can thus be analyzed

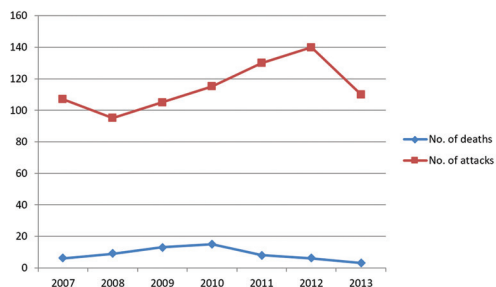


Figure 2: Trend of Pirate Attacks and the Associated Deaths of Fishing Crew in the Nigerian Industrial Trawler Fishery Sub-sector.

Source: Authors prepared pictographic

in the light of the Frustration-aggression Theory (FAT) proposed by Dollard, et al. in 1939 and further developed by Neal Miller in 1941 and Leonard Berkowitz in (1969). The proposition of the FAT is that aggression results from frustrating or blocking an individual's effort to legitimately attain a goal. The work of [6] supports the position of the FAT by hypothesizing that human frustration may lead to aggressive behavior and/or violence. According reference [6], frustration ultimately leads to aggression and aggression always implies that frustration has occurred at some previous times. The theory suggests that individuals become aggressive when there are obstacles blocking their legitimate drive to fulfill target goals and objectives. In the views of [7], aggression is a human behavior intended to harm another person who does not want to be harmed. This is exactly the case in the coastal communities in Nigeria where private ship operators are attacked for government negligence in providing care (employment, social welfare, quality education, modern healthcare facilities) for the society and the youth in particular. For example, the trend of revenue generation to the central government and contribution to the national GDP from maritime business operations such as ocean energy, maritime transport and shipping, industrial trawler fishery, etc. which have the coastal communities as hosts is increasing significantly over the years, but the standard of living, youth employment statistics, revenue allocation for coastal community development and poverty index shows negligible non-significant improvement and/or declining trend in most cases, even in the face of increasing youth population [8]. See Table 2 following page.

The table indicates the percentages of youth unemployment rates in the coastal communities and states defined by United Nations Development Programme [8] as the percentage of youth aged between

Table 1: Youth Unemployment and Underemployment Rates in Selected Coastal States in Nigeria

Coastal States	% of Youth Unemployment	% of Youth Underemployment
Akwa Ibom	11.3	33.7
Bayelsa	6.8	19.4
Cross River	1.8	12.0
Delta	9.3	29.2
Rivers	11.4	25.3

Source: Nigeria National Bureau of Statistics

15 to 34 years willing and ready to work; seeking for employment opportunities but could not find any. This is exclusive of youth who are doing fulltime studies in schools and are not seeking employment as such. The reality in the region however is that there is the preponderance of adults with ages above 35 to 40 years who are willing to work but who have never had the opportunity of being gainfully employed for the first time ever. Yet, this group watch and see the multinational oil, gas and other maritime companies tapping the natural resources in the communities posting millions of dollars of profits annually while government officials are spending petro dollars corruptly gotten from the resources of these coastal communities. The table below evidences the size and categorization of youth population of some selected coastal states in Nigeria.

The size of the youth population in relation to the aforementioned employment rates gives a clearer picture of the youth population that is either unemployed or underemployed. In analyzing the issue of youth violence in the Niger Delta, reference

[9] classified the youth population in the coastal states of the Niger Delta into three as follows:

- (1) Youths actively agitating for their rights of good living conditions and restoration of the dignity of coastal communities of the coastal states genuinely;
- (2) Youths on a deliberate mission to avenge the perceived betrayals of the coastal communities by elites in the region who are seen to have betrayed the youth for abandoning the struggle for the improvement of living standards in the region.
- (3) Youths engaged in criminal activities by their very natural disposition.

Reference[9] notes that while the first youth group are averse to the current state of affairs and queries their current socio-economic situation; and agitate that government should provide solutions to continued poor state of living, unemployment, poverty, environmental degradation, lack of basic social amenities, and infrastructures, etc. They seek to engage the government to provide genuine solutions to their problems but the tool

Table 2: Age Composition of Selected Coastal States' Youth Population in Nigeria

Age Categories	AKWA IBOM	BAYELSA	DELTA	RIVERS
15 -19	458,814	199,148	471,245	604,685
20-24	388,866	167,662	418,609	549,285
25-29	336,925	146,861	357,452	486,825
30-34	260,231	116,574	272,878	376,281
total	1,444,836	630,245	1,520,184	2,017,076

Source: Nigeria National Bureau of Statistics

for getting government attention is in most times violence or civil disruption [9]. They are forced to adopt the strategy of the natural criminals of group three such that each youth group metamorphoses into an aggressive violent group attacking investments and human resources in the coastal states.

The poverty trend in the coastal states is a further motivational factor pushing younger people into early preparation for violence, criminality and attacks against the activities of the multinationals and other maritime companies in the regions. This is after the sad experience of having seen the peaceful elderly lead a helplessly poor lifestyle which is a bad plight in comparison to the flamboyant and opulent lifestyles of the aggressive and violent militant and pirate groups. See the table below for the trend in poverty in some selected coastal states in Nigeria.

The table shows that all the coastal states making up the Niger Delta region had less numbers of poor people or poverty rate in 1980 but fell steeply deep into poverty as time progressed and has remained in it even in the face of increasing revenue earnings from the ocean energy operations and other maritime business activities. The Human Development Index (HDI) in the coastal communities in the Niger Delta region of Nigeria according [8] is 0.564. This is significantly less than that of countries and coastal regions having similar ocean energy reserve of oil and gas resources. For example, the HDI of Venezuela and Indonesia are 0.772 and 0.697, respectively [8]. UNDP also notes that the high prices of commodities within the coastal communities which limit purchasing power of low income earners induced by the high salaries paid to the employees of the oil and gas multinationals who may not

Table 3: Trends in Poverty in selected Coastal States in Nigeria (1980-2004)

Coastal state	1980%	1985%	1992%	1996%	2004%
Ondo	24.9	47.3	46.6	71.6	42.15
Rivers/bayelsa	7.2	44.4	43.4	44.3	29.09
Edo/delta	19.8	52.4	33.9	56.1	45.35
Cross River	10.2	41.9	45.5	66.9	41.61

Source: National Bureau of Statistics

Table 4: Fiscal Centralization of Proceeds from Ocean Energy to Federal and State Governments

Years	% share to coastal oil producing state governments	% share to Federal Government in Abuja
1960-67	50	50
1967- 1969	50	50
1969-71	45	55
1971-75	45 less proceeds from offshore	55 in addition to proceeds from offshore
1975-79	20 less proceeds from offshore	80 in addition to proceeds from offshore
1979-81	-	100
1982-92	1.5	98.5
1992-99	3	97
1999-	13	87

Source: Adapted from UNDP Report (2006).

even be from the host communities but reside within. This fiscally incapacitates the unemployed youth in the coastal communities from being able to adequately settle the costs of basic needs of housing, healthcare, transportation, education etc., thus making the scourge of poverty more felt [8]. Reference [9] traced the source of poverty in the Niger Delta and coastal communities to Federal Government's intentional deprivation of the coastal states and communities of the rights to the tapping of the resources found in their soil and skewed oil revenue sharing formula devised by the Federal government to starve the coastal communities of the revenue generated in their communities. See the table below for further insight into how the revenue sharing formula is seen as aiding further frustration and impoverishment of the coastal communities and states.

A perusal of the above table shows the fiscal deprivation of the coastal communities of proceeds from the resources in their communities and its centralization in the hand of the Federal and state governments who corruptly embezzle it without any form of developmental plan or investment in the human capital in the coastal zones. It equally shows that between the 1960s and 1971, the coastal states governments got between 50% -45% of the fiscal proceeds from the resources in the coastal states and by 1975 to 1980 got only about 20% while the Federal government took the rest 80% plus proceeds from offshore operations. When compared with the poverty data, we may rightly infer that the coastal states experienced less poverty and had less number of poor populations in the pre 1980 years up to 1980 when the coastal state governments were in control of the resources and earn a fair percentage of the fiscal proceeds from the maritime business operations. The post 1980 years particularly in 1981 which marked the period that the Federal Government took

hundred percent (100%) share of all proceeds from resources in the coastal communities and subsequent release to the communities of 1.5% (1982-1992) and a paltry 3% (1992 -1999) to the coastal states increased the trend of poverty incidence in the Niger Delta coastal communities and subsequently the frustration of the people living in the coastal communities. It's clear from the above table that the oil bearing coastal communities who lost their natural sources of employment (primarily fishing and agriculture) to the activities of multinational oil and gas companies were never considered in the sharing of the revenue proceeds from the resources under their soil. No developmental plan whatsoever was planned for coastal oil bearing communities while there exist development plans for other cities contributing nothing to the Federation account with proceeds from the coastal communities [10].

A feeling of fiscal deprivation possibly led to frustration, aggression and the violent demand by youths for a fair share of the resources from the region which now manifests as piracy and sea robbery as a backlash effect of the fiscal deprivation and poverty suffered by the coastal communities in Nigeria. A sight of the housing and living pattern in the coastal communities of Nigeria evidences further the incidence of poverty and deprivation. See Figure 3 below.



Figure 3: Common Housing Pattern in Typical Niger Delta Coastal Communities in Nigeria.
Source: Adapted from UNDP report, (2006)



Figure 4: Common Toilet House Found in Most Coastal Communities in the Niger Delta.

Source: Adapted from UNDP report, (2006)

Examining the piracy and armed robbery attacks against the industrial fishery sub-sector in the GOG and Nigeria maritime domain which constitute a major act of aggression and violence induced by the unrelenting drive by the youth of the coastal states and communities to derive economic gains from the business activities and operations in their maritime domain in a bid to escape the pang of poverty; the frustration-aggression theory (FAT) becomes a perfect explanation of the violence and attack against the ocean fishery industry by the youths of the coastal states in Nigeria in particular and the GOG states in general. The work of reference [11] notes that some of the youth involved in acts of violence and aggression against safe maritime operations have in the past risen to become prominent political actors, leaders and men of affluence in the region with connections to high ranking security personnel, politicians and government officials. The later fact becomes a motivating factor for younger youth to tow the line of piracy and aggression against maritime operators as the only avenue for economic advancement and escape from poverty.

For example, references [12] and [13] note that the recent upsurge in violence and pirate attacks in Nigeria industrial Fisheries sub-sector no doubt has profound negative effect in capacity building and development

of the trawler fishery sub-sector. They harp on the fact that the sector continues to lose lives of fishing crew, valuable equipment, vessels, and fishery products and revenue. Reference [13] and [2] valued the fishery products lost to violence of piracy and armed robber against fishing vessels over a period less than four years at over three billion (3billion) naira with overall losses of all components valued at Twenty billion (20 billion) naira in less than four years. IT is important to also state that the acts of piracy and sea robbery aggression against the fishery sector has left many members of onboard crew dead while some are permanently disabled with the negative multiplier effect on the Nigerian society. It is therefore necessary that an empirically determined solution strategy be developed taking into consideration the propositions of the FAT. In order words, to reverse the trend of revenue losses, human capital and equipment losses by the sub-sector; it will require a reversal of the trend, propensity and/or density of aggressive acts of piracy and armed robbery attacks against the sub-sector. To justify economic investments in human capital development in the region and catalyze stakeholders into the action of reversing it; the trends and magnitude of economic losses and the probabilities of loss, death, injury and kidnap etc., need to be empirical and holistically determined. As mentioned above, many studies have estimated the costs of piracy in different regions of the world including Nigeria but such an estimate failed to determine also the output losses associated with crew (human capital) deaths and injuries occasioned by pirate attacks in the waters of Nigerian maritime. This is a component part of the aggregate cost of maritime piracy needed as catalytic information for stakeholders to take remedial action against sea piracy in Nigeria based on the propositions of FAT. These form the central challenges which the study is cast to address.

2. Objectives of the Study

The aim of the study is to analyze the challenges of piracy and sea robbery attacks against the industrial trawler fishery sub-sector in Nigeria based on the frustration-aggression theory with a view to provide empirical economic loss information as justification for investment in human capital development in and employment in the coastal communities and for development of short and long term strategic solutions to the aggressive acts of piracy and sea robbery in Nigerian waters.

Other objectives are:

- (i) To estimate the output losses occasioned by fatal pirate attacks against industrial trawler fishery sub-sector in Nigeria between 2006 -2013.
- (ii) To determine the output losses as a result death and crew injury occasioned by pirate attacks in the global maritime industry between 2006 -2018.
- (iii) To measure the empirical probability coefficient of fatal pirate attack against the industrial trawler fishery sub-sector.
- (iv) To estimate the empirical probability coefficients of piracy induced risks of death, crew injury, kidnapping for ransom, missing, assault, hostage taking and death threats in the global maritime industry.

3. Brief Review of Literature

In Nigeria, the ocean economy holds enormous potentials of growth and has remained the major sources of revenue to the nation. The exploitation of the ocean resources in the coastal communities in Nigeria, particularly in the Niger Delta region has however caused the inhabitants of the region who originally were predominantly farmers and fishermen to lose their original sources of livelihood to the massive exploration and exploitation activities in the region [1]. The quantum of new jobs created by the new multinationals involved in the harnessing of the ocean economy is

continually inadequate compared to the number of unemployed youth yearning for gainful employment opportunities to fulfill their life goals.

Corruption too has made it impossible for the Government to re-invest adequately the proceeds from the ocean economy in the region in order to gainfully engage the unemployed youth. It can be inferred based on the aforementioned fact that the youth of the region is frustrated; seeing the near incapacity, un-readiness and refusal of the Government to use the proceeds from the ocean economy of the region to enhance the capacity of the youth to legitimately achieve their life goals via education and gainful employment [3]. By the propositions of FAT, Frustration precedes aggression while aggressive and violent behavior is the offshoot and brain child of frustration. It is believed that the Nigeria Government and the State Governments of the various coastal states made a clear choice of blocking the youth of the communities from legitimately reaching their goals by the continued underdevelopment of the coastal states and mostly by high level of graduate unemployment. In reacting to the frustration and blockade to legitimate achievement of life goals, the youth of the coastal states tend to have reacted aggressively through acts of violence, piracy and armed robbery against the maritime industry, having been well convinced that the maritime and blue economy holds the potentials to surely meet their needs of evolving from starvation, hunger, unemployment, etc., and ensure their economic emancipation. Unfortunately, all the sub-sectors of the ocean economy have suffered economically and socially, having been negatively impacted by the acts of piracy, terrorism and sea robbery; the industrial trawler fishery sub-sector seem to be the only organized group who have over the years been able to determine the quantum of direct financial losses

the sub-sector has suffered and made it a public knowledge. Thus the perception that the sub-sector has suffered the effects of piracy in Nigerian waters most over the years. For example, the ocean beyond piracy estimated the global aggregate macroeconomic cost of maritime piracy in the economies of different regions in 2010 alone at \$1.25billion. See Table 5 below for regional macroeconomic costs of piracy [5].

The report estimated the total global cost of piracy including cost of ransom paid for kidnapped crew, insurance, security equipment etc. to be between \$7 billion to \$12billion per year. See Table6 below for disaggregated cost of piracy on the global economy in 2010 alone.

The viewpoint echoed by many public opinion analysts is that the quest for freedom from economic strangulation by the coastal communities is a serious protest

against criminal neglect, marginalization, oppression and environmental degradation cum socio-economic hopelessness and in one word, frustration in the coastal communities [3]. There is multiplicity of evidence in literature linking the piracy and sea robbery attacks against ships in the coastal communities to multiple unaddressed deprivations and grievances by the people in the coastal communities caused by the government.

Unluckily, investments in the industrial trawler fishery sub-sector which are largely indigenous private sector investments aimed at harnessing the potentials of the Nigeria wide fishery resources is mostly affected by this frustration-aggression induced piracy, sea robbery and violence in the Nigeria maritime domain of the GOG. The Nigeria industrial trawler fishery industry represents the fleet of commercial

Table 5: Macroeconomic Cost of Piracy in 2010 Alone

Country	Cost Factor Categories	USD Lost Per Annum '000,000
Egypt	Revenue Losses due to use of Suez canal fees as against use of Gulf of Aden	642
Kenya	Impact on Trade	414
Yemen	Impact on Trade	150
Nigeria	Financial Losses by Oil and Fishing Industry	42
Sychelles	Financial Losses by Fishing and Tourism Industry	6
Total		1.25 billion

Source: Adapted from Ocean beyond piracy Reports (2010).

Table 6: Total Estimated Disaggregated Cost of Piracy in 2010

Cost factor	Cost (\$)
Ransoms	\$148 million
Insurance Premiums	\$460 million to \$3.2 billion
Re-Routing Ships	\$2.4 to \$3 billion
Security Equipment	\$367 million to \$ 2.5 billion
Naval Forces	\$2 billion
Prosecutions	\$31 billion
Anti-Robbery Organizations	\$19.5 billion
Cost to Regional Economies	\$1.25 billion
Total Estimated Cost	\$7 to \$12 billion per years

Source: Adapted from www.oceansbeyondpiracy.org (2010 piracy report)

motorized fishing vessels (trawler) employed in the wide ocean fishery sub-sector in Nigeria. It encompasses all the fishing trawlers owned and registered by members of the Nigerian Industrial Trawler Owners Association (NITOA) with which wide fishery resources in the Nigeria coastal and territorial waters is being harvested. The ocean fishery sub-sector is believed to be a very important sector of the nation's blue economy, contributing meaningfully to the GDP of Nigeria and overall economic growth [2]. However, the menace of youth aggression and violence in the coastal communities in the maritime domain evidenced by widespread acts of piracy and armed robbery against ships in the Nigeria maritime domain in particular and West African coast in general has direct delectation effect on the productivity, capital base, and general life of the industrial trawler fishery sub-sector as well as impinge on the ability of the sub-sector to supply fishery resources and employment for the economic wellbeing of Nigerians. Sustainable growth and development cannot be achieved in the drive to harness the blue economy and wide fishery resources of the region in the face of piracy, youth violence and aggression against indigenous fishing interests. Reference [14] notes that the consequences of the attacks is that the Atlantic coast of West Africa and Nigeria become a significant element in the security make up in Africa. Maritime insecurity is on the rise with the associated instabilities with wide range of socio-economic implications. According to [14], apart from the challenges of sea crimes and violence posed by this, maritime insecurity also impacts on livelihoods, cultures, histories, and social identities of coastal states who have the sovereign rights to maintenance of safe and secured waterways. Other consequences identified by [14] include challenges of environmental pollution and degradation, economic

distortions widespread social anomie in the coastal states and communities. Reference [15] opines that piracy in the Gulf of Aden for example causes disruption in relation to the overall volume of world seaborne trade. The study however notes that piracy in the Atlantic coast of West Africa has capacity to cause major disruption in global fossil energy supply and that will affect cost of global production and supply [15]. Moreover, piracy has led to the loss of particular shipping routes as vessel has to now bear the cost of routing ships particularly via canals. While many available literature in the study of piracy in the Atlantic Coast of West Africa center on measuring the direct revenue losses occasioned by it, trend and severity of attacks, issues of kidnap of expatriate workers for ransom, etc [16].

There exist literature gaps such that the output losses to the society associated with deaths of crew members and injury to crew members using the GOM of the HCM and/or other methods seems largely unavailable. Providing these evidences will aid in providing empirical justification for investment in maritime security programmes and policies in Nigeria and the Atlantic cost of West Africa.

4. Materials and Methods

Secondary data was obtained from the ICC International Maritime Bureau and the Nigerian Industrial Trawler Owners Association (NITOA) on the frequency and severity of pirate attacks against fishing vessels operating in the Nigeria maritime domain in the GOG covering a 13 year and 7-year periods of global and Nigeria attacks, respectively. Data on output per capital covering the same period (2006 -2018) was also obtained from the World bank reports. The Gross Output model (GOM) of the human capital model (HCM) used by World health Organization [17] for valuing human life was adopted and

used to estimate the economic cost of fatal and injury pirate attacks against fishing crew in Nigeria and the global maritime industry. According to the theory, the cost of death is not less than the loss of output which the victim of fatal attack would have contributed to the economy if alive. Similarly, the economic cost of injury is not less than the loss of output which the injured would have produced over the period of hospitalization/injury induced idle time/downtime. Reference [17] notes that valuing the economic cost of death of fatal incident victims by the human capital approach involves taking the discounted value of people killed in attack, since the loss of output is related to the nation.

By the Gross output model (GOM), life is valued as the total discounted value of the expected output and/or per capita output. Thus the value of the gross output represents expected economic benefit to the economy from saving a life in a fatal pirate attack or preventing an injury using security shields against aggressions of maritime piracy, violence and sea robbery.

For a fatal pirate attack involving death the economic cost of output lost per death is given as;

$$P_N = Y \left[\frac{1}{i} \right] \left[1 - \frac{1}{(1+i)^t} \right] \quad (1)$$

$$\text{Total output lost for several deaths} = P_T = Y \left(\frac{1}{i} \right) \left(1 - \frac{1}{(1+i)^t} \right) N \quad (2)$$

PN = National output forgone per death due to pirate attack.

PT = Total output forgone due to fatal attack involving more than a death.

Y = Average (national) output or per capital output.

i = is the social rate of discount (interest) which for developing countries tends towards 10 to 12 according to World bank records.

t = is the number of working years lost per fatality, defined as retirement age in public sector less national average age of

fatality for developing countries, tends towards 25.2 to 29 years. For injury whose hospitalization period is one years as used in the period, t=1.

N = total number of death in fatal attack over a period of time.

Using the method described above and the secondary data on fatal pirate attacks and injury to crew obtained; the output losses occasioned by maritime piracy induced crew deaths and injury was estimated.

4.1. Probability Theory

Furthermore, we used the empirical probability measure which is an offshoot of the probability theory used by [18] and [19] to determine the empirical probability of risks associated with pirate attacks against ships. The idea is to measure the magnitude and likelihood of risks of injury, death/killing of crew members, kidnap for ransom, assault, missing of crew members, hostage taking and threats to life in relation to the number of seafarers/maritime workers exposed to pirate attacks. The Probability theory deals with the chance or stochastic process also referred to as a random process. Probability is a ratio that measures the uncertainty that some events will occur based on the current operations. The risks occasioned by piracy and armed robbery against vessels as identified above are stochastic occurrences with fatal, injury, kidnap for ransom, assault, missing, hostage taking, and death threats forming major risks types identified by IMB assumed to be mutually exclusive and disjoint events. Probability theory asserts that:

P (successful outcome) = number of successful outcomes / Number of possible outcomes

This is the same for the probability of unsuccessful outcome.

Thus the sample space for risks induced by a single pirate attack is represented by the set formed by the sample points as:

$$S = \{Fd, Fi, Fk, Fa, Fm, Fh, Ft\} \quad (3)$$

The probability theory views an event as a subset of the sample space S.

Using the equally likely, fair chance or theoretical probability measure based on the above, we assign the same (fair) probability (P) = 1/N to each pirate attack risk type or outcome types of death, injury, kidnapping, assault, missing, hostage taking and threats to life.

Thus the equally likely probability (expected/theoretical probability) for each outcome type is: 1/7; i.e., 1/7 of the total seafarers exposed to attacks.

The theoretical probability measure assume fair chances for all risk types = 1/7 (N) (4)

The frequency function F(X) of a data set X = X1, X2, X3,...,Xn generates an empirical probability measure F'(X) defined by the equation:

$$F'(X) = \frac{F(X)}{N} \quad (5)$$

The Empirical probability function measure for each piracy risk type (outcomes of pirate attacks) of death, injury, kidnap for ransom, assault, missing of crew, hostage taking, and threats to life was computed using 13 years (2006 -2018) time series observed frequencies of occurrences of each risk type and employing equation (5) such that: Empirical probability coefficient for risks of pirate attacks are:

$$\text{For risk of Death} = F'(Fd) = \frac{F(Fd)}{N} \quad (6)$$

$$\text{Risk of injury} = F'(Fi) = \frac{F(Fi)}{N} \quad (7)$$

$$\text{Kidnap for ransom risk} = F'(Fk) = \frac{F(Fk)}{N} \quad (8)$$

$$\text{Missing crew risk} = F'(Fm) = \frac{F(Fm)}{N} \quad (9)$$

$$\text{Risk of assault} = F'(Fa) = \frac{F(Fa)}{N} \quad (10)$$

$$\text{Risk of threats to life} = F'(Ft) = \frac{F(Ft)}{N} \quad (11)$$

$$\text{Risk of hostage} = F'(Fh) = \frac{F(Fh)}{N} \quad (12)$$

Where:

N = aggregate and or average number of crew/seafarers exposed to attacks per period (per annum)

Fd, = frequency of death

Fi = frequency of injury risk

Fk, = frequency of kidnap for ransom

Fa, = frequency of assault

Fm, frequency of crew missing

Fh, frequency of being held hostage

Ft= frequency of death threats

The empirical probability coefficients have a relationship with the per capital output losses due to risks of death, injury, kidnap, etc. For example, given the numbers of crew/seafarers exposed to pirate attacks (N) in any given sea area or economy for any given period and/or year; the product of the empirical probability coefficient of risk of death F' (Fd)and the number of exposure (N) and output per capital/per death gives the total output lost by the economy occasioned by risk of piracy induced deaths over the period. Mathematically put we write that:

$$P_T = F'(Fd)(N)P_N \quad (13)$$

$$P_T = \frac{F(Fd)}{N} Y \left[\frac{I}{i} \right] \left[I - \frac{I}{(I+i)^t} (N) \right]$$

N = number of seafarers/crew exposed to pirate attacks

PT = magnitude of probable aggregate output lost due to risks of death in the economy.

Similarly, the output losses as a result of injury, kidnap, etc. can be determined but the period of injury hospitalization and kidnap took 1 year.

5. Limitations of the Study

It is important to state that the data used from the study were sourced from the Nigeria Industrial Trawler Owners Association (NITOA) and the International Maritime Bureau (IMB) piracy reports. Some pirate attacks in the industry may

go unreported according general public opinion. There accuracy of these estimations and findings of the study therefore depends to a large extent on the accuracy of the data used.

6. Results and Discussion of Findings

The result shows the average output lost per fishing crew death per annum (human capital death) occasioned by pirate attacks between 2007 and 2013 is \$22187.60 between 2007 and 2013. The aggregate output lost by the economy due to death of about 60 fishing crew members between 2007 and 2013 is \$1,275,257.505, representing an average annual total output loss of \$182, 179.64 per year. The result above represents the indirect output losses to pirate attacks due to deaths alone in the industrial fishery subsector of Nigeria. Similar levels of losses are possibly recorded due to risk of injuries, kidnapping for ransom, etc., which leaves the victims traumatized and unable to work for the periods of hospitalization and treatment. The output losses given above in addition to the direct revenue losses by the NITOA members between 2007 and 2013 indicates a monumental loss and a justification for immediate action of investment in human capital development and funding of youth entrepreneurial schemes and

the developmental projects in the coastal communities of the Niger delta, to alleviate the scourge of poverty among the youthful population for enduring solution to the violence of piracy and sea robbery in the Gulf of Guinea maritime domain. See the Table 8 for the financial losses (including decline in productivity, ransom paid for kidnap victims, material and revenue stolen by pirates etc.) by members of NITOA occasioned by piracy and armed robbery attacks against fishing vessel Nigeria.

NITOA report (2015) indicates that the trawler fishery sector lost an aggregate of ₦20,400,000,000 (\$56,666,666.67) revenue to pirate attacks between 2007 and 2013 indicating average direct financial losses of ₦3,342,857,142.86 (\$9,285,714.29) per annum over the period. By implication, a cumulative of ₦23,859,092,701.62 (\$66275257.52) was lost to pirate attacks as direct revenue losses and output losses due to death of fishing crew members in the sub-sector. Piracy and armed robbery attacks against the trawler fishery sector in Nigeria alone induces an annual cost of ₦3,408,441,814.5 (\$9,467,893.92) as cumulative cost (direct financial losses and cost of lost output due death of human capital) per annum. These amounts justify any investment in human capital in the Niger delta coastal

Table 7: Output Losses Due to the Risk of Fatal Attacks in the Industrial Trawler Fisheries Sector in Nigeria

Year	Deaths	PN = Output per death (\$)	PT = Total output losses caused by deaths(\$)
2007	6	17648.0323	105888.1938
2008	9	21015.7087	189141.3783
2009	13	17721.8126	230383.5638
2010	15	21480.2115	322203.1725
2011	8	23616.1864	188929.4912
2012	6	25739.3131	154435.8786
2013	3	28091.9421	84275.8263
Aggregate		155,313.207	1,275,257.5045
Average		22187.6010	182,179.6435

Source: Authors calculation based on NITOA data.

Table 8: Comparing the Direct Revenue Losses by NITOA and Output Losses Occasioned by Death of Fishing Crew in Naira

Year	Direct Revenue Losses in Fishing sector (₦)	PT = Total output losses caused by deaths(₦)
2007	2900000000	38,119,749.77
2008	3000000000	68090896.188
2009	3200000000	82,938,082.96
2010	3300000000	115,993.142.1
2011	3000000000	68.014.616.83
2012	3500000000	55596916.296
2013	4500000000	30339297.468
aggregate	23,400,000,000	459,092,701.62
Average	3,342,857,142.86	65,584,671.66

Source: NITOA. PT = Authors computation based on table10 in Naira. *Note: Exchange rate @360 naira = 1USD.

communities needed to break the bond of poverty and hopelessness in the coastal communities in a bid to suppress the act of violence and piracy in the Atlantic coast of West Africa at the long run. The likelihood and magnitude of the piracy induced output losses due to death can be forecasted by using the empirical probability coefficient as shown in the Table 9.

The empirical probability coefficient measures the likelihood of actual risk of death occasioned by pirate attacks as against the theoretical/expected probability which assign equal chances of occurrence to all piracy risk types and therefore cannot provide the right information for deployment of strategies against the occurrence of each risk type and the associated economic implications. The result of the analysis shows that the empirical

probability of risk of death occasioned by pirate attacks in the trawler fishery sub-sector of Nigeria is 0,007 with average exposure of one-thousand two-hundred and thirty-two crew members (1232) to pirate attacks in the GOG per annum. The implication is that 0.73% of all Nigeria and expatriate crew exposed to pirate attack in the waters of West Africa are killed each year by pirates. Another importance of the empirical probability measure is that if the trend of death by piracy continues, the product of the relationship between the empirical probability coefficient, the number of seafarers (fishing crew) exposed to attacks and the per capital output for the years gives the estimate of the quantum of total output losses per annum due to death of human capital per induced by piracy for that year. See equation 12.

Table 9: Average Empirical Probability Coefficient of Risk of Death of Fishing Crew by Pirate Attack in Nigeria 2007-2013.

Risk type	Empirical probability Coefficient	Average death per annum	Average exposure per annum	%
Death	0.007	9	1232	0.73

Source: Authors calculation based on NITOA data.

It is important to restate that piracy and armed robbery attacks in the maritime industry affects the global economy since shipping and maritime transport is a global commodity of trade and/or service industry. In Nigeria for example most multinationals operating in the offshore energy sector are foreign owned. Though the financial toll put by piracy in GOG by these organizations remain unreported apart from the often reported attack incidence and kidnaps. It should be the primary responsibility of both the Nigerian authorities, the multinational offshore energy companies in Niger Delta coastal communities and the global maritime industry to make necessary investments in human capital development, youth employment and entrepreneurial development programmes to provide lasting solution to violence and piracy in the GOG. The need for the involvement of

the global maritime industry necessitated the estimation of the quantum of output losses occasioned by piracy induced human capital deaths, and injuries in the global maritime industry using IMB piracy statistics and Nigerian per capital output data 2006– 2018.

The total global output losses (using Nigeria per capital output data and IMB data) by the shipping industry as a result of human capital deaths and injuries occasioned by pirate attacks between 2006 and 2018 are 1,474,447.48USD, and 681,735.6247USD, respectively. This implies that the industry lost average output per annum of 134,040.6800USD and 52,441.2019USD, respectively to deaths and injuries to shipping industry human capital. The above losses are exclusive of direct material and revenue losses, and cost of militarizing the waters ways as

Table 10: Determining the Output Losses Due to Sea Piracy Induced Death and Injury Risks in Ocean Economy using Output Per Capital in Nigeria 2006 - 2018

Year	Annual Deaths	No. Injured	PN = Output per death (\$)	PT = Total output losses caused by deaths(\$)	PNi=Output losses per injury (\$)	PTi = Total output losses caused injury risk (\$)
2006	15	15	15,520.70	232810.5	1507.34	22610.1
2007	5	35	17648.0323	88240.1615	1713.9497	59988.2395
2008	11	32	21015.7087	231172.7957	2041.0133	65312.4256
2009	10	69	17721.8126	177218.126	1721.1152	118756.9488
2010	8	37	21480.2115	171841.69	2086.1250	77186.625
2011	8	42	23616.1864	188929.4912	2293.5677	96329.8434
2012	6	28	25739.3131	154435.8786	2499.7625	69993.35
2013	1	21	28091.9421	28091.9421	2728.2462	57293.1702
2014	4	13	30196.6380	120786.552	2932.6511	38124.4643
2015	1	14	25584.1319	25584.1319	2484.6916	34785.6824
2016	-	8	20389.1171	-	1980.1597	15841.2768
2017	3	6	18445.4035	55336.2105	1791.3892	10748.3352
2018	-	8	19004.0644	-	1845.6455	14765.164
Sum			284,453.2613	1,474,447.48	27625.6565	681735.6247
average			21881.0201	134040.6800	2125.0505	52441.2019

Sourced Authors calculation based on IMB data. *Note: injury estimates are based on hospitalization period of 1 year.

temporary piracy suppression strategies as earlier identified in literature. Given the propositions of FAT, the magnitude of the losses induced by piracy on the global maritime industry and economy is a sufficient justification to catalyze actions for putting to a lasting end the violence of piracy in the GOG by investment in human capital development programmes, employment and youth entrepreneurial development. This is important, giving the interest of the global community in the region as a major hub of global energy supply. Further estimates of the global shipping industry output losses due to piracy induced death and injury risks in any economy can be determined using the per capital income of the economy, the empirical probability coefficient of each risk type and the number of maritime workers exposed to attacks. See the table below.

The result shows that given the trend of reported piracy and armed robbery attacks against the global maritime industry as reported by International Maritime Bureau (IMB) between 2006 and 2018; empirical probability coefficient of each piracy induced risk type aggregated over the period is 0.001, 0.043, 0.085, 0.0047, 0.0089, 0.82 and 0.022 respectively for death, injury, kidnapping for ransom, missing of crew, assault, hostage taking and threats to life. The global average exposure

over the same period is 585.3 maritime workers per annum. The results show that each year, about 1% of all maritime workers who experienced and/or are exposed to attacks by pirates are killed annually; 4.3%, are injured while 8.5% are kidnapped for ransom, 0.47% got missing while 0.89% are assaulted. About 82% are taken hostage until the pirates are able to perform their activities onboard while 2.2% suffer death threats. As stated earlier, the empirical probability coefficients of each risk type when multiplied with the number of maritime workers exposed to pirate attack and the per capital output of the economy yields the estimated output losses in the economy based on the gross output model (note that for injury and kidnap, the period of hospitalization and absence from work need to be specified). See equation 12. It is important to note that hostage taking has the highest likelihood of occurrence with empirical probability coefficient of 0.82 followed by the risk of kidnapping for ransom with empirical probability of 0.085. See Figure 5 below for an arrangement of the pirate attack induced risk types in order to decrease empirical probability and likelihood of occurrence.

7. Conclusion

Evidences from the findings of the study indicate that the Nigeria industrial

Table 11: Aggregated Empirical Probability Coefficients of Global Risks of Maritime Piracy (2006 -2013)

Risk type	Empirical probability Coefficient	Average death per annum	Average exposure per annum	%
F' (Fd)	0.01	7	585.3	1%
F' (Fi)	0.043	26	585.3	4.3
F' (Fk)	0.085	51	585.3	8.5
F' (Fm)	0.0047	6	585.3	0.47
F' (Fa)	0.0089	8	585.3	0.89
F' (Fh)	0.82	491	585.3	82
F' (Ft)	0.022	13	585.3	2.2

Source: Authors' calculation based on IMB statistics.

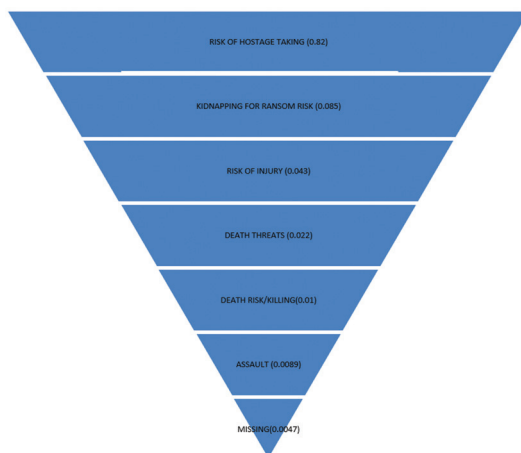


Figure 5: Empirical Probability of Pirate Attack Induced Risk Types Arranged in Decreasing the Order of Likelihood

Source: Authors based empirical probability coefficient of piracy risks result.

trawler fishery sector lost about 1,275,257.5045USD (₦459, 092,701.62) due to the death of human capital occasioned by pirate attacks in addition to 65,000,000USD (₦23, 400,000,000) direct financial losses between 2007 and 2013. The empirical probability of risk of death by pirate attack in the Nigeria ocean trawler fishery sector is 0.073, implying that about 0.73% of all fishing crew exposed to pirate attacks in Nigeria are killed annually. The global maritime industry is not left out as the global industry suffered output losses of 1,474,447.48USD and 681736.625USD, respectively to deaths and injury risk suffered by maritime workers between 2006 and 2018. This excludes direct financial losses, cost of security, security equipment and training, ransoms paid for release of kidnapped victims, etc. These findings lay credence to public opinion in Nigeria that any investment by the government and the multinational oil and gas corporations in the coastal oil bearing communities of the Niger delta in a bid to put to death the scourge of maritime piracy in the industry is economically justified. It is the opinion of this study that if a minor percentage of

amount being wasted by the Government as security budget in militarization the Niger Delta coastal communities annually in the bid to curb violence and pirate activities is dutifully spent in environmental and human capital development programmes cum creation of employment and youth entrepreneurial development and empowerment programmes annually in the coastal communities; the issue of piracy and armed robbery against maritime operators in the GOG will die a perpetual death.

8. Recommendation

Given that piracy and armed robbery attacks cost the Nigerian fishery industry cumulative output losses of 9, 467,893.92USD per year as revealed in the study; in relation to the Nigerian national minimum wage level of 83.3USD (₦30, 000) per month; the economic justification for investment and human capital development in the coastal communities can be based upon these values. By implication, with 9,467,893.92USD, the Government will successfully employ each year in relevant agencies of Government about 9,472 youths from the coastal communities at a monthly

wage rate equivalent to the national minimum wage level. The study thus recommend that the trend of frustration induced youth violence, aggression and piracy in the coastal communities in Nigeria and in the entire GOG should be addressed by implementation long term solution strategies that involve using a minor percentage of estimated piracy induced annual losses as a basis for investment in coastal community infrastructures and development programmes. The government and private sector stakeholders in the industry should strike an alliance to ensure the development of the coastal communities to enshrine peace in the waters of the Gulf of Guinea and Nigeria.

9. Suggestions for Further Studies

It is important that further studies be carried to forecast and determine the quantum of years (period of time) needed to crash the level of youth unemployment in the Niger delta coastal communities of Nigeria to the barest minimum by creating 9,472 jobs each year at monthly wage rate equivalent to the national minimum wage rate based on the estimated output losses of 9,467,893.92USD per annum due to piracy and sea robbery attacks. This will provide empirical data to enable stakeholders to plan a long term solution to the challenges of maritime piracy and sea robbery in the West African Coast.

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