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### THE CAUSAL RELATIONSHIP BETWEEN NATURAL GAS PRODUCTIONS AND IMPOTENT REGULATORY FRAMEWORK ON GAS FLARING IN NIGERIA

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#### ABSTRACT

*This study investigates the dynamic causal relationship between gas productions and the impotence of the gas flaring regulatory laws and policies in Nigeria. The theoretical models adopted for the study is the law and economics framework of Posner<sup>3</sup> and Akaike's econometric time-series frameworks. The data for the study consisted of Nigeria's annual gas export value from 2007 to 2017 which formed the dependent variable and, the impotence of the gas flaring regulatory laws was substituted with the data of the World Bank's Global Gas Flaring Reduction Partnership (GGFR) and the Nigerian Extractive Industries Transparency Initiative data on the financial values of the losses and damages caused by the laxity in enforcing the laws, representing the independent variable. The models of KPSS and ADF were used in testing the stationarity of the variable. Granger time series causality model was used for data analysis. The results show that, there is a two-way relationship between the variables. The results therefore indicates that, the weaker the regulatory laws, the higher the production and flaring of natural gas. Also the higher the production and flaring of natural gas, the more the regulatory laxity persists.*

**Keywords:** Crude Oil, Gas, Environment, Regulations, Laws, Nigeria.

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<http://www.law.uchicago.edu/Lawecon/index.html> retrieved September 18, 2017.

## 1. INTRODUCTION

As of December 2017, Nigeria has over 190 trillion standard cubic feet of natural gas reserves,<sup>4</sup> meaning that it is ranked in the top 10 of the world's natural gas producing countries. However, reluctance of the government to implement the existing laws and to compel the oil corporations to act reasonably as to safeguarding the environment has been at the centre of scholarly debates concerning the consequences of the inflows of foreign direct investment in Nigeria. The mining of crude oil and natural gas has caused unembellished environmental dilapidation in the local communities where the crude oil productions are taking place. The ecological effects are numerous and becoming severe to such extent that water sources are contaminated. The waterways are facing sustained damages, thus rendering the inland coastlines very uninhabitable as toxic wastes are deposited; gas flaring and crude oil spillage are persistent, and the incidence of gas flaring is continuous. There is the need for adequate regulations and efficient enforcement of the laws governing the industry.

Despite the ecological hazards, it is estimated that Nigeria lost US\$14.298 billion between April 2008 and October 2016 from gas flaring.<sup>5</sup> The losses are attributed to failure of the multinational oil corporations (hereinafter referred to 'MOC') to comply with the laws and regulations. In essence, the MOCs have also failed to pay the stipulated fine of US\$3.5 for every 1,000 Standard Cubic Feet (SCF) of gas flared.<sup>6</sup> The problems are subsisting irrespective of the existence of the Regulation 42 of the Petroleum (Drilling and Production) Regulations, 1969; the Associated Gas Re-injection Act, 1979; and, the Associated Gas Re-injection (Continued Flaring of Gas) Regulations, 1984 which are meant to stem the tide of gas flaring in the country.

According to the records of the Nigerian National Petroleum Corporation (NNPC), from 2008 to 2016, the MOCs in Nigeria flared an estimated total of 4.085 trillion SCF of natural gas. A closer view at the data reveals that in 2008, 631.19 billion SCF of gas was flared; 2009, 2010, 2011, 2012 and 2013 recorded total gas flare of 509.35 billion SCF, 581.568 billion SCF, 619.033 billion SCF, 588.667 billion SCF and 409.31 billion SCF respectively. Again, in 2014 and 2015, total gas flared was 285.762 billion SCF, and 341.37 billion SCF; while between January and October 2016, 119.15 billion SCF of gas was flared. Using the old and subsisting penalty rate of N10 per 1,000 SCF, the total of 4.085 trillion SCF of gas flared recorded in this period translated to N40.85 billion accruing to the Federation Account. On the other hand, using the new penalty rate of \$3.5 per 1,000 SCF of gas, which is yet to be enforced, the country would have earned \$14.298 billion, which would amount to N2.86 trillion, using an average exchange rate of N200 to a dollar. This implied that due to the failure of the Federal Government to enforce the new rate, the country has lost about N2.818 trillion over these years.<sup>7</sup> These figures are not independent hence may not portray the true state of the problems. This is the reason why several scholars suggested that the investors in crude oil and other mineral resources are not often transparent. Hence there is the tendency for economic and civil unrest to erupt within the developing countries where the MOCs undertake the bulk of mineral extractions. The lack of transparency in enforcement of regulations in Nigeria is a consequence of huge dependency on crude oil.

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<sup>4</sup> See: Global Gas Flaring Reduction Partnership (GGFR) reports, 2017. It is also important to note that, as far back as 2007, Nigeria started producing 1,204 billion cubic feet (Bcf) of natural gas per day, while consuming 456 Bcf that year. During that year alone, approximately 749 Bcf were exported mostly as liquefied natural gas (LNG). Also in 2007, Nigerian exports of LNG to the United States were 95 Bcf making it the third largest source of LNG imports after Trinidad (447 Bcf) and Egypt (115 Bcf). Source: Nigeria liquefied natural gas corporation, Annual Audit, 2007.

<sup>5</sup> See the audit report of the Nigerian Extractive Industries Transparency Initiative, 2016. Cited in Vanguard of 10 January 2017, <https://www.vanguardngr.com/2017/01/non-implementation-gas-flare-penalties-costs-nigeria-n2-9trn/> Retrieved 22 January 2018

<sup>6</sup> *ibid*

<sup>7</sup> *ibid*

Kingston<sup>8</sup> observed that trustworthy empirical studies on the impact of crude oil production in mineral dependent countries in Africa are very scarce. Alfaro<sup>9</sup> researched into the impact of foreign direct investments (FDI) on a cross section of countries using cross-country data from 1981 to 1999. Alfaro's found that foreign direct investment accrues benefit to the host countries where mainly manufacturing industries are undertaken, but very catastrophic in the host countries where mineral extraction is the main economic activity of the foreign direct investors. Ross<sup>10</sup> argued that the host countries wholly depending on oil and gas as the foremost sources of national income are disposed to dwindling economic development, insecurity and deficient governance. Unfortunately, Ross did not support his findings with real-time evidence. His study over-relied on cumulated data from the governance and economic indicators of selected countries. The study lacked empirical backings. Hence, the study did not fully explore the key variables such as the standards of living, inflation, human rights, environmental pollution etc.. Xing and Kolstad<sup>11</sup> explains that multinational corporations often prefer to invest capital in countries where the laws and enforcement of environmental protections are weak. This is so because, many multinational corporations are not keen on complying with pollution control laws of the host countries.

There are several other studies that found the links between mineral extractive industries and civil unrest including civil war.<sup>12</sup> Irrespective of the likelihood of triggering civil skirmishes, Al Gedicks<sup>13</sup> suggests that the countries that rely on only mineral resources as source of national wealth are disposed to high rate of poverty. Therefore, the stakeholders of foreign direct investments that are actively involved in petroleum and gas sectors and that are operating in the lands of the native people in the developing countries are aiding the population decline among the ethnic people. This is because the extractive industries such as gas production and other forms of mining activities are taking over the lands, polluting same and exterminating the natural habitat and native cultures. However, Al Gedicks failed to provide an explanation as to how gas flaring for example causes population extinction. However, in Nigeria, it is estimated that the reckless emission of natural gas in the Niger Delta is largely responsible for the death of least 200 people per year. Officials of the government admit that gas flaring in the country accounts for about 40 per cent of the total gas flared annually across Africa, which is valued at \$7 billion in wasted resources.<sup>14</sup> As of December 2017, Nigeria ranked 7<sup>th</sup> among the countries that are notorious for gas flaring in the world. The other countries that were ranked above Nigeria during the same period are: Russia, Iraq, Iran, the United States, Venezuela and Algeria.

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<sup>8</sup> Kingston, Kato Gogo (2017) *Pollution And Environmental Responsibility In Petroleum Extraction In The Niger Delta Of Nigeria: Modelling The Coase Theorem*. (Germany: Lambert Academic Publishing) ISSN 978-3-330-04808-9 (305 pages).

<sup>9</sup> Alfaro, L (2003) *Foreign Direct Investment and Growth: Does the Sector Matter?* Harvard Business School, p. 12

<sup>10</sup> Ross, M (2006) *A Closer Look at Oil, Diamonds, and Civil War*; *Annual Review of Political Science* 9: 265-300

<sup>11</sup> Xing Y and Kolstad C D. (2000) *Do Lax Environmental Regulations Attract Foreign Investment?* Paper of the International Development Program, International University of Japan and Department of Economics, University of California, Santa Barbara, CA 93106-9210 USA

<sup>12</sup> See: Fearon, J D & Laitin, D. D (2003) *Ethnicity, insurgency, and civil war*; *American Political Science Review* 97(1): 1–16; Ross, M. L. (2003) *Nigeria's Oil Sector and the Poor*; Prepared for the UK Department for International Development "Nigeria: Drivers of Change" program (May 23); Ross, M (2006) *Mineral Wealth and Equitable Development, A Background Paper for the World Development Report*; Ross, M (2006) *A Closer Look at Oil, Diamonds, and Civil War*; *Annual Review of Political Science* 9: 265-300; Collier, Paul, and Anke Hoeffler (2004) *Greed and Grievance in Civil War*; *Oxford Economic Papers* 56, 663-95; and De Soysa, I (2002) *Paradise is a Bazaar? Greed, Creed, Grievance and Governance*, *Journal of Peace Research* 39(4): 395–416.

<sup>13</sup> Al Gedicks (2001) *Resources Rebels*, Canada: South End Press

<sup>14</sup> Henry Umoru. *Nigeria accounts for 40% of gas flared annually in Africa* — *Senate, Vanguard*, 1st June 2017. Online at: Read more at: <https://www.vanguardngr.com/2017/06/nigeria-accounts-40-gas-flared-annually-africa-senate/> retrieved 22 January 2018

Natural gas production in Nigeria is hugely under the control of foreign direct investors. The enterprise is, thus, under a joint venture (JV) arrangement. The JV is made up of the Government (represented by The Nigerian National Petroleum Corporation), and three multinational corporations namely: Total, Shell BP, and Agip. The consequences of having Africa's largest natural gas JV are substantial. One of the downsides of the exploration and exploitation of crude oil in Nigeria is gas flaring. A combination of the data obtained by Friends of the Earth, UNDP and the World Bank from 2009 to 2017 consistently shows that, the oil and gas companies in Nigeria are responsible for the daily emission of well over 70 million cubic metres of gas into the atmosphere. The consequence is that, on daily basis, more than 70 million tonnes of carbon dioxide is discharged into the entire geographical area in the Niger Delta environment.<sup>15</sup> This routine activity of the corporations is largely responsible for the to greenhouse effect on the environment and the largest in Africa to such extent that it is larger than the combination of all other sources of greenhouse contributors in the entire Africa.

## 2. THE EFFECTIVENESS OF THE REGULATORY FRAMEWORK

Nigeria has made attempts to eradicate gas flaring by the enactment of a key legislation namely, the Associated Gas Reinjection Act, 1979 (herein referred to as the 'AGRA'). Nigeria's involvement in crude oil production started in 1957 thus, within such number of years, there ought to be adequate regulatory regime to manage the very vital economic activities of that sector of the economy. The reality is that there were no specific laws regulating the production and flaring of gases. The first attempt at checking the menace of gas flaring was the enactment of the Associated Gas Reinjection Act, 1979. The preface of the Act explicitly states the intents that the aim and objectives are to oblige all the oil companies operating in Nigeria to design and submit the documentary evidence of their proposed plans for the dealing with gases associated with crude oil production. The preliminary contingency plans must illustrate how the companies shall minimise reckless emission of gas by way of re-injection. For this reason, section 1 of the Act provides that each and every oil company operating in Nigeria must submit the documentary plans on how they intend to utilize gas associated with petroleum production. A deadline of April 1<sup>st</sup> 1980 was set for the companies to submit the documented plans to the Minister of petroleum resources. Also, it was required that the contingency plan document must contain at least two crucial aspects as follows: (a) A demonstrated evidence of a practicable plan for utilization of natural gas from all oil wells; and, (b) An estimated plan for gas re-injection of gases that are not consumed by the site equipment and machinery.

Furthermore, section 2(1) of AGRA made it mandatory for every company engaging in oil and gas production activities in Nigeria to hand in to the Minister of Petroleum, the full details of the programmes and plans of their activities. The comprehensive plan must include all the information concerning the operation of programmes of action to carried out to accomplish the re-injection of all gases and related matters; or the practical arrangements for the sustainable utilization of the gases to be produced. It also, stipulated the 1<sup>st</sup> of October, 1980, as the deadline for submission. Section 3(1) forbids all companies from engaging in any form of flaring gases that are produced in the course of crude oil production. However, pursuant to section 3(2) of the AGRA, the petroleum minister may permit gas to be flared upon the application for consent being made by the relevant oil company. Section 4 stipulates the penalty for violation. Any violating company is to lose the concessions allowed to the firm. Such withdrawal of concession licence is to affect the specific crude oil field that the illegal gas flaring was conducted.

Despite the enactment of the Associated Gas Reinjection Act, there is the concern among observers that Nigeria is reluctant to implement some aspects of the Act, for instance, section 4 is widely ignored hence, the oil companies are persistently violating law in absence of deterrence.

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<sup>15</sup> K G Kingston. African Journal of Social Sciences Volume 1 Number 1 February 2011 pp. 1-13

Kingston<sup>16</sup> observes that, Nigeria consistently enact environmental protection laws and several supplementary legislation but no genuine efforts are being made to compel the polluting organisations to act in accordance with the laws. The direct consequence of the sloppiness of enforcement of the laws are manifesting in the magnitude of the violation of the human and environmental rights within the geographical areas where the corporations are conducting crude oil activities.

Kingston,<sup>17</sup> emphasised that the the possibility of the oil corporations halting gas flaring in Nigeria is not foreseeable. Kingston's source of affirmation flows from a piece of information obtained from the British archives dated 1963, which shows that the United Kingdom approved that its own oil corporation, Shell should flare gases in Nigeria so long as it was a necessary aspect of crude oil production. The said archive document was a secret letter written by the British Trade Commissioner to the United Kingdom Foreign Office in London. The content explicitly states that Shell BP shall unavoidably 'flare gas' in very large quantity in its crude oil production facilities across Nigeria. The document also acknowledged that, the emission and flaring of gases by Shell BP is likely to cause huge consequences including the wanton waste of Nigeria's resources.<sup>18</sup> The 1963 letter also noted that ShellBP should persuade the Nigerian authorities with the argument that the flaring of gas and the economic value of the repatriation of profits from Nigeria is less than the overall foreign exchange Nigeria is earning from the entire oil production enterprise.<sup>19</sup>

The consequences of gas flaring in Nigeria also attracted international condemnation, for instance, the United Nations Development Programme (UNDP) reports on human development in the Niger Delta of Nigeria lamented that gas blazing is a colossal waste of the treasured resources. It classified the act of flaring as thermal pollution which is destroying the ecosystem. It went further to explain that the flaring of gas are largely responsible for the unhealthy rise in noise and temperatures of the local communities. Therefore, that, the direct negative effects include: Death of plants, animals, insects, and aquatic lives. It also contended that continuous exposure of humans to the gas flares is harmful to health.<sup>20</sup>

Despite series of explicit UNDP reports on the persistent consequences of gas flaring in Nigeria, it has never apportioned blame to the polluting oil corporation responsible for the menace. The reports also, did not suggest how the problems should be addressed and solved. Ime, *et. al*<sup>21</sup> conducted an empirical study in and around the Easter Obolo communities where crude oil are being exploited. The objective of the scientific study was to ascertain the magnitude of hazards that gas flaring and oil spills were causing to the environment. The study found among others, that there are unacceptable high level of toxic deposits in the soil and water within the entire geographical area. Hydrocarbon degraders and polycyclic aromatic hydrocarbons were found in very volatile quantities. Also, there were high level of other dangerous toxins including hydrocarbons of biogenic, petrogenic and pyrogenic origin. The researchers warned that the toxins and organism are the types that are extremely irrepressible pollutants. They further explained that the organisms are very treacherous and spread very quickly and capable of causing contamination of a large area in a relatively short time-scale. They also remarked that the quantity of the polycyclic aromatic

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<sup>16</sup>Kato Gogo Kingston. Shell Oil Company in Nigeria: Impediment or Catalyst of Socio-economic Development? African Journal of Social Sciences, 1(1) pp. 15-36 (2011)

<sup>17</sup>Kato Gogo Kingston, An Alternative Approach to the Ecological Effects of Mixed Pollution in Eastern Obolo. Sacha Journal of Environmental Studies, 1(1) pp. 41-48 (2011)

<sup>18</sup>Gas Flaring in Nigeria; A Human Rights, Environmental and Economic Monstrosity. Being a publication of the ERA and Friends of the Earth, Amsterdam, June 2005, p. 5; Online at: [www.eraaction.org](http://www.eraaction.org) retrieved July 14, 2010.

<sup>19</sup> *ibid*

<sup>20</sup> UNDP (2006), UNDP: Niger Delta, Human Development Report (Nigeria)

<sup>21</sup>Ime R. Udotong, Samuel I. Eduok, Joseph P. Essien, and Basil N. Ita (2008) "Density of Hydrocarbonoclastic Bacteria and Polycyclic Aromatic Hydrocarbon Accumulation in Iko River Mangrove Ecosystem, Nigeria"; Report sponsored and published by the World Academy of Science, Engineering and Technology Volume 34, found online at: <http://www.waset.org/journals/waset/v44/v44-136.pdf> [retrieved 11/2/2018]

hydrocarbons in the waterways in the area the types that are persistent and saturates in water and soil ecosystems due to their hydrophobic physiognomies. The study expressed concern on the foreseeability of the spread of the pollutants to the rivers, creeks, sounding inland waterways, soils, lakes, estuaries and the Atlantic Ocean which is less than 5 kilometres from the gas flaring facility. Despite numerous studies and reports on the negative externalities of gas flaring in Nigeria, not much effort has been made to tighten the weak laws and, not much has been done to improve enforcement of the laws. However, there has been an attempt at using social solutions to address the legal problems.

### 3. ATTEMPTED SOCIAL SOLUTIONS

On the 17<sup>th</sup> day of May 1989, the Federal Government incorporated the Nigeria Liquefied Natural Gas Company (“the NLNG”) with the goal of curtailing gas flaring that has been wasting the natural resources for nearly five decades. The corporation was given statutory backing by the enactment of the Nigeria LNG (Fiscal Incentives, Guarantees and Assurances) Act, 1990.

The NLNG<sup>22</sup> is jointly owned by four partners, namely, the Nigerian National Petroleum Corporation (NNPC) with 49% of the shares;<sup>23</sup> Shell holds 25.6% shares; Total Gaz Electricite Holdings France holds 15% and Eni holds 10.4% of the shares. The NLNG conducts economic activities through two major subsidiaries, namely, Bonny Gas Transport (BGT) Limited and NLNG Ship Management Limited (NSML). According to the official records of the NLNG, the corporation brags that it shall eliminate gas in Nigeria. It is easier said than done. There is no doubting that the NLNG is reducing gas waste by converting it into liquid form for easy distribution, however, neither the NLNG Act nor the operating instruments of the NLNG corporation provides the procedures on how to stem the tide of the regulatory non-compliance by the other oil companies operating and flaring gas in Nigeria.

### 4. METHODS AND MATERIALS

#### 4.1 *Data Collection and Verifications*

The study was conducted in the Niger Delta of Nigeria. The Akaike<sup>24</sup> information criterion (AIC) was used as a guide in selecting the lag length of ten years from 2007 to 2017 within which data were compiled. The AIC is a statistical estimator of the comparative quality of statistical data for a given set of variables. The AIC thus, is used to estimate the quality of each variable in the time-series model in relation to every other model used in the study. The data for the study comprised of Nigeria’s annual gas export value from 2007 to 2017 which sum-up as the dependent variable and, the impotence of the gas flaring regulatory laws were approximated with the data of the World Bank’s Global Gas Flaring Reduction Partnership (GGFR) and the Nigerian Extractive Industries Transparency Initiative data on the financial values of the losses and damages caused by

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<sup>22</sup>The mission statement states: “Nigeria LNG will be a global LNG company renowned for its operational excellence, cost leadership, high HSE standards and for honesty and integrity. We will be helping to build a better Nigeria by utilising the country’s gas resources and helping to put out the flares, thus diversifying the economy and cleaning up the environment. We will set the standards in community relations and technology transfer to Nigerians and actively promote the sustainable development of Nigerian businesses. We will provide to our shareholders a good return on their investment. We will provide for our staff an exciting and fulfilling place to work and the opportunity to develop their potential. We will execute and operate our business in Nigeria with an international outlook and mindset;” Adapted from the company website at: <http://www.nlng.com/Our-Company/Pages/Profile.aspx> retrieved 11 February 2018.

<sup>23</sup> The NNPC represents the Federal Government of Nigeria in the Joint Venture

<sup>24</sup>Akaike, H. (1976) Canonical correlation analysis of time series and the use of an information criterion, cited in Systems Identification, ed. R. K. Mehra & D. G. Lainiotie, 27-96. New York: Academic Press.

the slackness in enforcing the laws, representing the independent variable. The models of KPSS<sup>25</sup> and ADF<sup>26</sup> were used in testing the stationarity of the variable. Granger time series causality model was used for data analysis. Data verifications were conducted using Johansen;<sup>27</sup> and Johansen and Juselius<sup>28</sup> models of cointegration analyses. Further evaluations were conducted to confirm whether the outcomes of the econometric analyses possess the long-run or short-run implications to law, economics and public policy in Nigeria using the *Ordinary Least Square Regression (OLS)*.

#### 4.2 The Analytical Models

This study adopted the bivariate using the econometrics time-series model of Professor Granger's<sup>29</sup> causality, to examine the connection between gas productions and the impotence of the gas flaring regulatory laws and policies in Nigeria. The time series  $x_t$  Granger causes another time series  $y_t$  if the present value of  $y_t$  can be better projected or predicted by using the past values of  $x_t$  than by not doing so, taking into account also that other relevant information (including the past values of  $y_t$ ) are used in either case. In essence, the Granger test requires the presentation of a regression of variable  $x_t$  on its own lag values  $x_{t-i}$  and the lag values of the second variable  $y_{t-i}$ . Sufficient attention is taken to avoid the incidence of serial correlation in the two variables  $x_t$  and  $y_t$  making it possible for the occurrence of an acceptable level of correlation. If the results show that the coefficient of the lag of any of the variables is significant, it can be said that the variable with the significant coefficient "Granger causes" the other variable.

In this study, the Granger model is organised in aggregation with other time-series test enhancements, including Johansen;<sup>30</sup> and, Johansen and Juselius<sup>31</sup> test for cointegration of the variables. Dickey and Fuller's<sup>32</sup> ADF unit root tests establish whether the two variables have unit roots. It is important to note, that where a variable has a unit root, it is considered to be non-stationary hence, may lead to unauthentic result in time-series regression. For this reason, the substitute test known as the KPSS test can be used to verify for stationarity. Finally, the Ordinary

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<sup>25</sup>The KPSS otherwise known in econometrics as the model of Kwiatkowski; Phillips; Schmidt; and Shin tests. The test format is usually adopted for evaluating null hypotheses that observable time series data are stationary around a deterministic trend (i.e. trend-stationary) against the alternative of a unit root. See: Kwiatkowski, D., Phillips P.C.B., Schmidt P., Shin Y. (1992) Testing the null hypothesis of stationarity against the alternative of a unit root; *Journal of Econometrics* 54, 159-178

<sup>26</sup>Generally, in statistics and econometrics, the ADF coined from the, *Augmented Dickey-Fuller* test is used to assess null hypotheses to verify that the unit roots of the variables are present where time series samples are used in a research. It ascertains whether a variable is stationary or not. See: Dickey, D. A. and Fuller, W. A. (1981) Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root, *Econometrica*, 49, 1057-72.

<sup>27</sup> Johansen S. (1988) Statistical analysis of Cointegration vectors, *Journal of Economic Dynamics and Control*, 12:231-54

<sup>28</sup>Johansen, S. and Juselius, K. (1990) Maximum likelihood estimation and inference on cointegration-with application to the demand for money", *Oxford Bulletin of Economics and Statistics*, 52: 169-210

<sup>29</sup>Professor Clive William John Granger was a British econometrician known for his contributions to non-linear time series propounded the granger causality model which was popularized by the Chicago School of Law under the auspices of the Law and Economics School of Thought. Professor Granger died in 2009 was a Nobel prize winner for his expertise. Granger, C. W. (1969) Investigating Causal Relations by Econometric Models and Cross-Spectral Methods, *Econometrica*, 37 (3), 422-438; Granger, C. W. (1994) Some Comments on Empirical Investigations Involving Cointegration, *Econometric Review*, 13 (3), 345-350; Granger, C. W. (1980) Testing for Causality, *Journal of Economic Dynamics and Control*, 2, 329-352' and, Granger, C. W, J. (1981) Some Properties of Time Series Data and Their use in Econometric Model Specification, *Journal of Econometrics*, 16, 121-130

<sup>30</sup> *ibid*

<sup>31</sup> *ibid*

<sup>32</sup> *ibid*

Least Square Regression test is therefore used to verify whether the possible existence of a long-run causal relationship between the variables.

#### 4.2.1 ADF Unit Root Test

The Augmented Dickey Fuller (ADF) and the KPSS were used to test for the unit roots and the stationarity of the variables namely – gas productions and the impotence of the gas flaring regulatory laws and policies in Nigeria. The results of these tests show that both variables are stationary are can be relied upon. The results are presented in Table 1:

Table 1: Results of KPSS Unit Root Tests

Series	Test Statistics			
	ADF		KPSS $\mu$	KPSS $\tau$
	Level 1 (2007-2017)	Level 2 (2007-2017)	Level 1 and 2	
Gas production	21.8900** (10)	76.1022** (10)	0.110002*** (10) <i>0.123201***</i> (10)	0.011437*** (10) <i>0.011460***</i> (10)
Laxity in the regulatory laws	12.60238** (10)	10.34010** (10)	0.112350*** (10) <i>0.115519***</i> (4)	0.111072*** (4) <i>0.1210439***</i> (4)
First Difference				
Gas production	8.10133** (10)	14.01432** (10)	0.0112321(10) <i>0.1134222(10)</i>	0.143201(10) <i>0.1494587(10)</i>
Laxity in the regulatory laws	6.1259**(10)	10.73464**(10)	0.003120(10) <i>0.004432(10)</i>	0.177635(10) <i>0.170283(10)</i>

**Note:** The abridgement  $\mu$  and  $\tau$  signify the models with drift and the trend. The results in *italics* signify results for 2007-2017 data series on the KPSS; \*\* signifies the refutation of the presence of unit root at 1% and 5% of the ADF critical values. The figures in parentheses are the lag of the determination of both models. The ADF lag is selected in compliance with Akaike Information Criteria (AIC) (See: Akaike, 1976). The ADF critical value is 1% and 5% correspondingly. The KPSS critical value is 0.216, 0.176, 0.146 and 0.119, in conformity with the upper tail critical values as postulated by Kwiatkowski *et. al.* (1992). The asterisks \*\*\* signifies acceptance of the null hypothesis of stationarity.

#### 4.2.2 Cointegration Tests

The cointegration tests were conducted with Johansen;<sup>33</sup> and, Johansen and Juselius<sup>34</sup> encompassing two steps, that is, the “trace test” and “maximum Eigenvalue test” as follows:

(a) The trace test ( $\lambda_{\text{trace}}$ ) is represented as follows:

$$\text{Trace} = -T \sum_{i=r+1}^n \log(\hat{\lambda}_i) \quad (1)$$

In equation (1); the null hypothesis is that the cointegration vectors is  $\leq r$  as opposed to the reverse hypothesis that the cointegration vectors = r.

<sup>33</sup> Ibid

<sup>34</sup> ibid



(b) The maximum Eigenvalue test ( $\lambda_{\max}$ ) is represented as follows:

$$\lambda_{\max} = -T \log(1 - \hat{\lambda}_i) \quad (2)$$

In equation (2) the null hypothesis is that the cointegration vectors = r as opposed to the optional null hypothesis that the cointegration vectors = r+1. The results are presented in Table 2.

Table 2: Johansen Cointegration Test

Results for $x_t$ and $y_t$ Series				
Null hypothesis	Maximum Eigenvalue	1% Critical value	Trace Statistic	5% Critical value
Mineral Exploration ( $x_t$ )				
R = 0	5.1440**	6.4421	10.908**	17.903
R < 1	13.3030	8.2029	59.400	60.876
Pollution ( $y_t$ )				
R = 0	5.104**	2.508	9.7609**	32.645
R < 1	7.187	8.387	9.710	11.006
** Implies rejection of the null hypothesis of NO COINTEGRATION at 1% critical level				

Table 2 presents the result of the Johansen cointegration tests. It shows that the hypothesis of “no cointegration” ( $r = 0$ ) at 1% and 5% level is rejected. The result also shows that the hypothesis of “no cointegration” ( $r < 1$ ) is also rejected 1% and 5% critical level implying that the variables are co-integrated. It also shows that there is long-run equilibrium relationship between gas productions and the impotence of the gas flaring regulatory laws and policies in Nigeria.

#### 4.2.3 Granger Causality Test

The study carried out the Granger causality tests using the models in equations (3) and (4) aided by the deployment of *Microfit 5.0* software which considers the bivariate linear autoregressive model of variables  $x_t$  and  $y_t$ .

$$x_t = \alpha_0 + \sum_{i=1}^p \alpha_i x_{t-i} + \sum_{i=1}^p \beta_j y_{t-j} + \varepsilon_{x,t} \quad (3)$$

$$y_t = \alpha_0 + \sum_{i=1}^p \alpha y_{t-i} + \sum_{i=1}^p \beta_j x_{t-j} + \varepsilon_{y,t} \quad (4)$$

Table 3 shows the results of the Granger causality tests. The information from the results are that, the increase of the quantity of gas produced in Nigeria over a ten-year period tends to follow the consistent lack of deterrence of the environmental protection and regulatory laws. Secondly, the creation of NLNG and the enactment of the NLNG Act pollution is not found to have a significant effect in reducing gas flaring. There is, therefore, a two-way Granger causality between gas production/gas flaring and the laxity of the laws in Nigeria.

Table 3: Results of the Granger Causality tests

Null Hypotheses	Observations	F-Statistic	P-Value
The production of natural gas in Nigeria “Granger” causes laxity in the enforcement of the regulatory laws.	10	86.024	-0.0003***
The laxity in the enforcement of regulatory laws “Granger” causes large scale production of natural gas in Nigeria.	10	78.720	-0.0008***
*** Implies acceptance of the null hypotheses at 1% and 5% critical levels			

#### 4.2.4 Ordinary Least Square Regression (OLS)

The study exhibited the OLS regression to verify the long-run relationship of the variables. The test was conducted using the Microsoft Excel for Windows 2013 version. The results are presented in Table 4. The outcome of the OLS test in Table 4 shows that the coefficient of determination is 0.8641140 meaning that roughly 86% of  $y_t$  can be clarified by  $x_t$ . Hence, 86% of revenue of gas productions in Nigeria is elucidated by the ineffectiveness of the gas flaring regulatory regime. The p-value is 0.00021, therefore  $p < 1$  and significant at the 1% critical level, signifying that there is a long-run equilibrium relationship between the variables.

## 5. RESULTS AND DISCUSSION

This study adopted the models of law and economics with the time-series models of Granger in the investigation of the causal links between gas productions and the impotence of the gas flaring regulatory laws and policies in Nigeria. The results of the unit root tests show that the variables are stationary and reliable. The result of the cointegration test shows that the null hypothesis of *no cointegration* is rejected. This result suggests that the variables are unified in the same statistical order I(1) thus sufficiently adequate for the study.

The results of the Granger causality tests show that there is the existence of a two-way causality relationship flowing from the productions and flaring of gas to the laxity in the regulatory laws in Nigeria. Also, the Ordinary Least Square Regression (OLS) statistic approves the certainty of a long-run stability relationship between the variables, implying that the continuousness of gas exploitation, and the resultant gas flaring depend on the febleness of the monitoring laws in Nigeria. Therefore, gas flaring/production will continue to be connected with pathetic regulatory laws and policies. The OLS test results additionally, shows that at least 86% of the gas flaring in Nigeria can be ascribed to the laxity in the regulatory laws. Therefore, the probability of the obliteration of gas flaring and the resultant negative externalities in Nigeria in the near future is less than 1%.

Table 4: Ordinary Least Square (OLS) Results

SUMMARY OUTPUT				
<i>Regression Statistics</i>				
Multiple R		0.3410402		
R Square		0.8641140		
Adjusted R Square		0.005114		
Standard Error		3.72126		
Observations		10		
<i>ANOVA</i>				
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>
Regression	10	8635.008111	7622.398	17.92021
Residual	14	2584.973004	230.0052	
Total	22	10100.27207		
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.154348	15.24130141	0.131222	0.003003
X Variable 1	1.014152	0.173320469	5.245962	0.00021**

\*\* Indicates significance at 1% critical value

The findings, therefore explains why it has not been possible to hold oil corporations liable for the consequential effects of environment pollution in Nigeria. For example, in *Gbemre v Shell Petroleum Development Company Nigeria Limited and Others*,<sup>35</sup> Gbemre and seven other persons represented eight villages and communities<sup>36</sup> in the Niger Delta of Nigeria, in a lawsuit against the defendants. The cause of action was that the defendants' nonstop flaring of gas caused damages to the claimants' health and communities. Hence, the claimants applied to the court to seek for remedy of damages and an injunction to restrain the defendants from gas flaring. The action was brought under the Chapter 4 of the Constitution of the Federal Republic of Nigeria, 1999 (as amended) and the human rights provisions of the African Charter. The issues for determination were: (i) Whether the defendant violated its duty of care; and, (ii) Whether the pollution of the claimant's environment by the flaring of gas from the facilities of the defendants violated the human rights of claimants.

It should be noted that sections 12 and 20 of the 1999 Constitution (as amended) pledges the freedom of safe environments. Also, the entire Chapter 4 of the same constitution guarantees human rights. Specifically, sections 33 and 34 provides for the fundamental rights comprising the right to life. In accordance with paragraph 1 of the National Environmental Protection (Effluent Limitation) Regulations 1991, all oil companies in Nigeria are required to set up anti-pollution apparatus for the decontamination of emission and biochemical pollution.<sup>37</sup> By the same token, paragraph 1, 2 and 3 of the National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, 1991 prohibits the discharge of dangerous or poisonous elements into the air, water or land of Nigeria.<sup>38</sup> Articles 4, 16 and 24 of the African Charter on Human and Peoples Rights (Ratification and Enforcement) Act also provides for the protection of the environment.<sup>39</sup> It was on the strength and premises of the aforesaid laws and regulations that, the claimants in *Gbemre* based their arguments. The claimants further invoked the

<sup>35</sup> AHRLR 151 (NgHC 2005)

<sup>36</sup> The communities are: Rumuekpe, Eket, Imiringi, Gbarain, Iwherekan, Eremah, Akala-Olu, and Idama

<sup>37</sup> Kato Gogo Kingston. *Pollution and Environmental Responsibility In Petroleum Extraction In The Niger Delta Of Nigeria: Modelling The Coase Theorem*. (Germany: Lambert Academic Publishing, 2017), p. 138.

<sup>38</sup> *ibid*

<sup>39</sup> *ibid*

common law doctrine of ‘*duty of care*’ to emphasize that the defendants were negligent, and but for the negligence, the damages would not have occurred.<sup>40</sup>

Despite the decision of the court in *Gbemre’s* case, that defendants, “were guilty of committing crimes against humanity,”<sup>41</sup> the court explained that there were “widespread” and “systematic”- violation of the claims’ rights to life and healthy environment. The court awarded damages against the defendants and, granted an injunction restraining the defendants from further flaring of gases in the affected communities. However, the claimants have not been able to enforce the judgment benefits against the defendants because another court of co-ordinate jurisdiction granted a permanent stay of execution of the judgment in favour of the oil corporation. The outcome of *Gbemre’s* case clearly illustrates the inter-relationship between gas flaring/production and the weakness of Nigeria’s legal and institutional frameworks. Nonetheless, Nigeria ratified Article 24 of the African Charter on Human and Peoples Rights and domesticated same by enacting the African Charter on Human and Peoples Rights Act. The main operating aspect of the Act expresses that: Every Nigerian have the rights to live in reasonably safe atmosphere complimentary to their advancement. However, the reality is that, the people that are residing within the communities and lands where natural gas is produced are not being protected by the authorities that the laws mandated to do so. This was illustrated in the case of *Gbemre v. Shell*.<sup>42</sup>

In *Social and Economic Rights Action Centre (SERAC) and Another v Nigeria*,<sup>43</sup> the African Commission on Human and Peoples’ Rights condemned Nigeria’s inability to uphold to the protection of human and peoples’ environmental rights. It remarked that the insufficient protection of human rights including the rights to safe and healthy environment. It queried why the national level of protection has not mirrored the international standards. This study affirms Potter<sup>44</sup> and Scott<sup>45</sup> pollution heaven hypothesis which explains that the multinational corporations often move their investments to countries where the government is less strict in enforcing laws and regulations that requires compliance with environmental safety. Potter<sup>46</sup> and Scott,<sup>47</sup> concludes that the corporations that already operating in specific countries may decide to leave if the government strengthen the laws, alternatively, they may decide to remain and take all steps to weaken the such laws and thwart the enforcements.<sup>48</sup>

The prevalence of gas flaring and the ensuing pollution in Nigeria contributes to the accumulation of profits of the corporations.<sup>49</sup> The refusal of the corporations to re-inject the surplus gases into the earth and, the wilful negation of the statutory obligation to decrease gas flaring enable the corporations to maximise profits by reducing the transaction cost of exploiting crude oil.

The absence of enforceable transnational corporate laws against the multinational corporations implies that each country should enact and enforce laws that preserves the self-worth and human rights of its citizens. In Nigeria, the exploration and production of crude oil and natural

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<sup>40</sup> See: *Donoghue v. Steven* [1932] UKHL 100 and *Rylands v. Fletcher* [1868] UKHL 1

<sup>41</sup> Kato Gogo Kingston, 2017, op. cit, p. 139

<sup>42</sup> AHRLR 151 (NgHC 2005)

<sup>43</sup> AHRLR 60 (ACHPR 2001)

<sup>44</sup> Porter, M. E. (1990) *The Competitive Advantage of Nations*. New York: Free Press; and, Porter, C (1999) *Trade Competition and Pollution Standards: Race to the Bottom or Stuck at the Bottom* 8:2 *Journal of environment and Development*, 133.

<sup>45</sup> Scott, W.R (2004) *Institutional Theory: Contributing to a Theoretical Research Program*, in *Great Minds in Management: The Process of Theory Development*, Ken G. Smith and Michael A. Hitt, eds. Oxford UK: Oxford University Press.

<sup>46</sup> Porter, M. E. (1990) *The Competitive Advantage of Nations*. New York: Free Press; and, Porter, C (1999) *Trade Competition and Pollution Standards: Race to the Bottom or Stuck at the Bottom* 8:2 *Journal of environment and Development*, 133.

<sup>47</sup> Scott, W.R (2004) *Institutional Theory: Contributing to a Theoretical Research Program*, in *Great Minds in Management: The Process of Theory Development*, Ken G. Smith and Michael A. Hitt, eds. Oxford UK: Oxford University Press.

<sup>48</sup> Also see: Y. Xing and C D. Kolstad. *Do Lax Environmental Regulations Attract Foreign Investment?* Paper of the International Development Program, International University of Japan and Department of Economics, University of California, Santa Barbara, CA 93106-9210 USA (2000)

<sup>49</sup> Kingston, 2017, op. cit, p. 197

gas is drenched with foreign investors. This has created severe environmental devastations in the host communities. The consequences are numerous including – the pollution of: Ground water, inland waterways, ecosystem and biodiversity.<sup>50</sup>

The findings of the present study support Alfaro<sup>51</sup> which suggested that foreign direct investments only benefits the host countries where such investment is wholly manufacturing in nature. Furthermore, Alfaro reiterated that, corporations of the extractive industries inflict harms to the lands and environment in the host countries. The present study confirms Ross<sup>52</sup> which concluded that countries that depend on petroleum and gas as the main source of foreign earnings are often have numerous social, political and economic difficulties. This present study confirms the previous finding of Kingston<sup>53</sup> which suggest that, the high degree of environmental pollution occurring in Nigeria's oil and gas producing territories is very different from the pollution occurring in other countries that crude oil business is taking place. Kingston went further to suggest that the reason for the disparity is the over dependency of Nigeria on foreign assistance for military and economic backings. The multinational corporations in the petroleum sectors are mostly originated from the countries that are rendering the much needed assistance to Nigeria hence, the government of Nigeria lowers the law enforcement powers of the laws to mollify the foreign investors.

## 6. CONCLUSION

This study re-enforces Kingston's<sup>54</sup> finding which suggest that the laxity in enforcing the relevant laws to protect the environment is rooted in the deficiencies in the structural arrangement of Nigeria's federalism in that governing structure Nigeria is semi-unitary whereby power flows from the centre (federal government). It is the concentration of the powers in the federal government which makes it easier for regulatory capture to occur. Corrupt national leaders are easily influenced by the intensify lobbying of the multinational corporations.

The policy implications of this empirical legal treatise are wide reaching. The host developing countries where multinational corporations are conducting gas production activities should recognise that the intentional weakening of the standards of the regulatory laws with regards to crude oil and gas undertaking will continue to have severe long term consequences irrespective of the short term financial gains. It is also important to realise that by lowering and weakening the national laws to achieve competitive benefits over international rivals, the environmental and human rights of the citizens suffer maximum violations.

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<sup>50</sup> *ibid*

<sup>51</sup> L. Alfaro. Foreign Direct Investment and Growth: Does the Sector Matter? Harvard Business School, April 2003

<sup>52</sup> M. L Ross. Nigeria's Oil Sector and the Poor; Prepared for the UK Department for International Development "Nigeria: Drivers of Change" program (May 23); M. L Ross. Mineral Wealth and Equitable Development, A Background Paper for the World Development Report, (2006); and, M.L Ross. A Closer Look at Oil, Diamonds, and Civil War; Annual Review of Political Science 9: 265-300 (2006).

<sup>53</sup> Kato Gogo Kingston. Pollution And Environmental Responsibility In Petroleum Extraction In The Niger Delta of Nigeria: Modelling The Coase Theorem. (Germany: Lambert Academic Publishing, 2017), p.98

<sup>54</sup> *Ibid*, p. 201