

Entrepreneurship and Environmental Sustainability: Evidence From Nigeria

Joshua Sunday Riti^{1*} Ali Madina Dankumo² Happy Daniel Gubak³

1. School of Economics, Huazhong University of Science and Technology, Wuhan, China

2. Department of Economics, Federal University, Kashere, Gombe State, Nigeria

3. Department of Political Science, University of Jos, Nigeria

*riti.joshua@yahoo.com, kumotito@yahoo.co.nz, lagubakson@gmail.com

Abstract

The study conducts an investigation on the causal relationship between Entrepreneurship and environment using the co integrating regression (COINTREG) or Fully Modified Least Squares approach (FMOLS). Annual time series data is employed for the period spanning 2000-2012. The results which emanated from the findings depict that there was the existence of a long run relationship between entrepreneurship and CO₂ per capita (a measure of environmental sustainability). The results further reveal the existence of the Environmental Kuznets Curve (EKC). The percentage of the service sector shows a positive relationship with CO₂ emission. This is owing to the erratic power supply in Nigerian economy which makes service firms dependent on self-power generators that make use of fossil fuels and emit large sum of CO₂. The policy lesson from the findings shows the framework that entrepreneurship has massive impacts on environmental sustainability. Therefore the study recommends opportunities in green building, renewable energy, sustainable agriculture; recycling business and green financing created by degrading environment in Nigeria should be adopted for environmental entrepreneurship to boost sustainable economic development. While the erratic power supply in Nigeria should also be improved upon to reduce the use of self-power generators that use fossil fuels and emit large sums of CO₂.

Keywords: Entrepreneurship, Environmental Sustainability, EKC, C02, Service Sector

JEL Classification: O31, Q56, O44

I. Introduction

Ensuring environmental sustainability is the seventh goal of the United Nations Millennium Development Declaration which range from sanitation to clean air in global atmosphere. The study derived its topic from this declaration made in September 2000 by world leaders at Millennium Summit which Nigeria was part of the summit (Rio+20, 2012).

The impact of entrepreneurship on environmental sustainability in the Nigeria economy has right relevance to the Nigeria economy at this point in time when every economy of the world is taken measures to sustain her development for next generations. Nigeria is faced with the special challenge being one of the oil producing countries and uses large amount of fossil fuel in its economy. This study is in right perspective because it is done on the basis of continuous environmental degradation of Nigeria as a result of entrepreneurial activities. The recent flooding across the federation and threat of extinction of some biodiversity organisms are reasons for the study. Also, the reason for the Nigerian economy to be both intra-generational and inter-generational equities by discounting for the future are another reasons for the study. All these underscore author's personal conviction and sense of responsibility for future generations.

Environmental indices in Nigeria are not encouraging ones, they are alarming in terms of negativity. Environmental Performance Index (EPI) 2012 ranks Nigeria 119 out of 132 countries leaving Nigeria only better than Eritrea and South Africa in sub Saharan region of Africa. Also, the International Human Development Index (HDI) sustainability indicators in relation to Nigeria which includes carbon dioxide emission per capita is 0.6(tonnes); population living on degraded land is 11.5% and change in forest area 1990/2010 is -47.5% (UNDP, 2012). This environmental degradation has adverse effect on the economy as a whole. Others include threat of extinction and endangered biodiversity in Nigeria are also alarming, the flood incident of last year, 2013 was seen as the worse in fifty years, this is also an evident of rate of environmental degradation.

All these components of environment degradation are caused majorly by economic activities by human on the environment in order to eke a living. This brings us to the focus of this research study which investigates the impact of entrepreneurship on the environment of Nigeria and how to encourage the growth of environmental entrepreneurs rather than just entrepreneurs that do not care about the sustainability of our environment for sustainable development. There are environmental challenges in Nigeria economy that limit the growth and development of its economy. Deforestation is one of the major problems faced by Nigeria environment; pollution which is atmospheric or air pollution, aquatic or water pollution and land or surface area pollution; flooding and erosion is a common occurrence in many part of the country.

This paper examines the concept of sustainpreneurship or environmental entrepreneurship in relation

to Nigeria economy. The concept is relevance for economic development that is not based just on physical development but also development on quality of life by managing the global commons. This study seeks to answer the following questions: What is the impact of entrepreneurship on environmental sustainability? Can entrepreneurship activities be managed to sustain the environment? The paper is divided into five sections. Following the introduction in section I is the review of related literatures which occupies section II. Section III takes the impact of entrepreneurship on the environment. The methodology and analysis of relevant data on environmental entrepreneurship occupies section IV. While section V takes the conclusion and some recommendations.

II. Conceptual And Theoretical Issues

2.1 The Concept of Entrepreneurship

Entrepreneurship has a divergence of views and there are many definitions in the concepts as much as there are authors. This can be attributed to its significance and individual differences in embarking on business activities for economic growth and development.

Khanka (2002) puts it as “an elusive concept”. This shows that the concept of entrepreneurship is multi-dimensional and it is difficult to be limited to a discipline of study. According to Ronstadt (1984) entrepreneurship is “dynamic process of creating incremental wealth”. This view is tenable to the motive of an individual entrepreneur because he hopes to make profit or increase his wealth. But, not only entrepreneur that create wealth, wealth can even be created through the means that are not legitimate. Another view by Hisrich and Brush (1995) state that entrepreneurship is the process of creating something different with value by devoting the necessary time and effort, assuming the accompanying financial, psychological and social risks and receiving the resulting monetary rewards, personal satisfaction, and independence. This definition is more than just defining the concept but goes further by showing motive and attributes of an entrepreneur. The Hisrich and Brush statement of “creating something different... has relevance to middles lower income countries like Nigeria because a large number of their entrepreneurs are not investing anything new rather they copy based on foreign inclinations.

Furthermore, according to French famous economist Say (1803) cited by Hisrich and Peter (1992) “an entrepreneur is someone who consciously moves economics resources from area of low yield to area of high yield”. This definition is in compliance with the optimization concept of theory of firm in economics. The economics resources are limited which calls for optimal utilization of the available one so there will be efficiency with limited resources available to entrepreneur by alternating different investment options available to him.

A further inquiry into the concept also shows that entrepreneurship is a process of organizing other factors of production. Kpelai (2009) writes entrepreneurship is the coordinating factor which brings the other factors of production together and entrepreneurship is the driving element behind organization.

2.2 The Concept of Environmental Sustainability

The concept of environmental sustainability continues to be a contentious issue at all levels of economics, governance and various fields imbedded in the concept. The Brundtland Report (1987) writes “in the middle of the 20th century, we saw our planet from space for the first time.... From space, we see a small and fragile ball dominated not by human activity and edifice but by a pattern of clouds, oceans, greenery and soils. Humanity’s inability to fit its activities into that pattern is changing planetary systems, fundamentally. Many such changes are accompanied by life-threatening hazards. This new reality, from which there is no escape must be recognized and managed”. This shows a graphical analysis of how important our environment is essential for a sustained human existence”.

The word sustainability has three components: environmental, social and economic but its definition remains an abuse term. The term cannot be defined, and there are no accepted criteria with supporting test method to measure it (Morelli, Greenwood, Lockwood & Portillo, 2010). Environment is a space that supports life and non-living elements. The word environment distinguishes itself from the word ecology, which can be characterized as a concept of interdependence of element within a system (Morelli, 2011). Environmental sustainability, then, is limited to and, in fact becomes a subset of ecological sustainability.

“Environmental Sustainability could be defined “as a condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity” (Morelli, 2011). This definition puts limit to the growth of economic activities without causing damage to life supporting system in the environment. If entrepreneurs at any level continue to produce, the capacity of supporting ecosystems become endangered if restrictions are not lay on rate of natural resources usage. This definition is more precise and practical than the one given by the Brundtland Report (1987) “meeting the needs of current generation without compromising the ability of the future generation to meet their

needs". The Brundtland Report definition is not specific and incorporates the three aspects of sustainability—environmental, economic and social.

Goodland (1995) defines environmental sustainability as “the two fundamental environmental services—the sources and sink functions—must be maintained unimpaired during the period over which sustainability is required”. Goodland’s definition is more tenable to all economies and the two fundamental environmental services are crucial to sustainable development. The source has to do with environmental inputs in production process; their nature—renewable or non-renewable will determine the limit to their exploration. On the other hand, sink function has to do with the consumption of output generated by source function; waste assimilation of consumption should be within absorptive capacity of the environment.

Thus, environmental sustainability is an environmental issue but its relevance to economic and social well being of humans and other species are crucial to their existence. Therefore, environmental sustainability can be defined as the study of maintaining living organism and non-living organism within environment as human activities go on within it and without its degradation.

2.3 Environmental Kuznets Curve (EKC)

The Environmental Kuznets Curve (EKC) hypothesis postulates an inverted-U-shaped relationship between different pollutants and per capita income, i.e., environmental pressure increases up to a certain level as income goes up; after that, it decreases. An EKC actually reveals how a technically specified measurement of environmental quality changes as the fortunes of a country change. A sizeable literature on EKC has grown in recent period. The common point of all the studies is the assertion that the environmental quality deteriorates at the early stages of economic development/growth and subsequently improves at the later stages. In other words, environmental pressure increases faster than income at early stages of development and slows down relative to GDP growth at higher income levels. It proposes that there is an inverted U-shape relation between environmental degradation and income per capita, so that, eventually, growth reduces the environmental impact of economic activity (Panayotou, 1993).

The environmental Kuznets curve (EKC) is a hypothesized relationship between various indicators of environmental degradation and income per capita. In the early stages of economic growth degradation and pollution increase, but beyond some level of income per capita, which will vary for different indicators, the trend reverses, so that at high income levels economic growth leads to environmental improvement. This implies that the environmental impact indicator is an inverted U-shaped function of income per capita. Typically, the logarithm of the indicator is modeled as a quadratic function of the logarithm of income. An example of an estimated EKC for Nigerian economy is shown in Figure 1 in the appendix. The EKC is named for Kuznets (1955) who hypothesized that income inequality first rises and then falls as economic development proceeds.

The EKC concept emerged in the early 1990s with Grossman and Krueger's (1991) path-breaking study of the potential impacts of NAFTA and the concept's popularization through the 1992 World Bank Development Report (IBRD, 1992). If the EKC hypothesis were true, then rather than being a threat to the environment, as claimed by the environmental movement and associated scientists in the past (e.g., Meadows, Meadows, Randers, & Behrens, 1972), economic growth would be the means to eventual environmental improvement (Dasgupta, Laplante, Wang & Wheeler, 2012). This change in thinking was already underway in the emerging idea of sustainable economic development promulgated by the World Commission on Environment and Development (1987) in “*Our Common Future*”. The possibility of achieving sustainability without a significant deviation from business as usual was an obviously enticing prospect for many—letting humankind “have our cake and eat it” (Rees, 1990).

The EKC is an essentially empirical phenomenon, but most of the EKC literature is econometrically weak. In particular, little or no attention has been paid to the statistical properties of the data used—such as serial dependence or stochastic trends in time-series—and little consideration has been paid to issues of model adequacy such as the possibility of omitted variables bias. Most studies assume that, if the regression coefficients are nominally individually or jointly significant and have the expected signs, and then an EKC relation exists. However, one of the main purposes of doing econometrics is to test which apparent relationships, or “stylized facts,” are valid and which are spurious correlations.

2.4 Socio-technical System Approach

Hughes (1989) argues that “technological systems contain messy, complex, problem-solving components. They are both socially constructed and society shaping. Among the components in technological systems are physical artifacts, such as turbo, generators, transfer and transmission lines in electric light and power systems. Technological systems also include organization, such as manufacturing firms, utility companies, and investment banks, and they incorporate components usually labeled scientific, such as books, articles and university teaching and research programmes. Legislative artifacts such as regulatory laws can be part of technological systems”. Socio-technical system theory argues that economic goal should not only be recalibrated like measuring GDP as

an indicator of economic performance and social progress. Rather, environmental vitality should also be included as indicator in measuring GDP (Stiglitz, Sen, & Fitoussi, 2009). Thus, goal direction can help to sustain our environment.

2.5 Resilience Social-ecological Systems Approach

“The concept of resilience social-ecological systems incorporates the idea of adaptation, learning and self-organization in addition to the general ability to persist disturbance” (Folke, 2006). The term “resilience” originated in the 1970s in the field of ecology from the research of Holling (1973), who defined resilience as “a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationship between population and state variable”.

The concept of a resilient social-ecological system approach to environmental sustainability considers the systems of human and nature. Buttressing further Walker and Salt (2006) note “a resilient social-ecological system in a ‘desirable’ state has a greater capacity to continue providing us with the goods and services that support our quality of life while being subjected to a variety of shocks”. In this approach, three aspects are central: resilience, adaptability and transformability (Umberto 2012).

“A system’s resilience can be measured by its distance from its threshold- a break point between two regimes of a system. The closer it is to a threshold, the less it takes to be pushed over. To maintain a given threshold in environmental content means not exceeding the breaking points so there will be no regime shift” (Umberto, 2012). The other central theme to a resilience approach is how social-ecological systems change overtime, hence, systems dynamic. Umberto (2012) writes on adaptability as “it describes how an ecosystem organizes itself and how it responds to a changing world” (Umberto, 2012). Thus, environmental resources can be sustained to the level of their adaptability in ecosystem.

The transformability of this approach is “the capacity to create a fundamentally new system when ecological, economic or social (including political) conditions make the existing system untenable” (Umberto 2012). The backdrop of the transformability to environmental sustainability is whether a resources is renewable or not (Perman et al. 1997). Holling (2001) laying emphasis on this approach puts succinctly:

“The era of ecosystem management via incremental increases in efficiency is over. We are now in an era of transformation, in which ecosystem management must build and maintain ecological resilience as well as the social flexibility needed to cope, innovate and adopt” (Holling, 2001”).

2.6 Empirical Review

“The past decades have witnessed a growing interest and attention to the role of business in driving sustainability in general (Bansal & Roth, 2000; Hart, 1995; Porter & van der Linder & Shrivastava, 1995), and to the ability of entrepreneurs to promote environmental welfare in particular (Anderson and Leal, 2001; Dean & McMullen, 2007; Larson, 2000)...and environmental entrepreneurship (Anderson & Huggins, 2008; Cohen and Winn, 2007; Dean and McMullen 2007), which address the pursuance of opportunities for profit that simultaneously deliver environmental benefits (Meek, Pacheco & York, 2009). This section will focus in the works on environmental entrepreneurship and reviewing the gap in their studies.

Dean and McMullen (2007) have syntheses theory from the entrepreneurship, environmental, and welfare economics literatures to develop a conception of environmental entrepreneurship as a subset of the broader concept of sustainable entrepreneurship and outline the means by which entrepreneurial action can resolve environmental challenges by overcoming barriers to the efficient functioning of market for environmental resources (p.51).

They argued that environmentally relevant market failures (Public goods, externalities, monopoly power, inappropriate government intervention, and imperfect information) represent opportunities for entrepreneurs and simultaneously achieving profitability while reducing environmental degrading economic behaviour (p.58).

Another work by Cohen and Winn (2007) is similar to the above but different in term of market failure component. Cohen and Winn treated four market failures-“firms inefficiency; externalities exist; imperfect price mechanism; and imperfection in information” (p.30). More important in their research is that it shows the impact of human activities on ecosystem.

Given the above works in environmental entrepreneurship, there are gaps in the study that this research work provides solutions within its context. Both works fail to provide empirical relationship between entrepreneurship and environmental sustainability and show the degree of discrepancies so that proper solution can be proffered to environmental degradation. Another gap associated with the review work is it geographical broadness. Both cover global economy or system and no direct link with a particular region. This research work will build on these empirical works to eliminate these gaps in the context of Nigerian economy.

Despite these gaps in study of the reviewed works, they have credit for being works that approach sustainability more in environmental manner in relationship to entrepreneurship.

III. Impacts of Entrepreneurship on Environmental Sustainability In Nigerian Economy

Economic activity is inevitably environmentally disruptive in some way satisfying the material needs of people requires the use and disturbance of energy flows and materials. Entrepreneurship often than not has negative impacts on environment and it is called environmental degradation.

Table 1.0 helps in illustrating the situation that is obtainable in environmental resources market failures. Comprising four sections- A1, A2, A3, and A4- each measure the impact of entrepreneurial activity with its environmental cost or degradation. From section A1 in table 1.0, forestry share in real GDP (%) is compared with forest grow stock to measure the depletion of forest resources as a result of economic activity in the forestry industry in Nigeria economy. The table shows that when contributed highest to GDP in a year 2000, the corresponding 2.10 square kilometer forest land cover was depleted in Nigeria. Thus, a high entrepreneurial activity resulted in an inevitable environmental destruction. Also, as the share decline, the rate of depletion of Nigeria forest resources also reduce from -2.1-sq.km in 2000 to -1.80sq.km in 2010.

Another impact between real GDP growth rate and the Co2 emissions per GDP in kilogram is observed in section A2 of the table 1.0. It shows there is more impact on climate change when the income increases in Nigeria economy. The trend in this section shows that with the lowest growth rate of real GDP within the years covered; 4.63% in 2002 the CO₂ emissions per GDP were at its smallest also in the same year (i.e. 37.80kg). The time series data had shown the impact of economic activity on the quality of Nigeria climate because emissions of CO₂ per GDP growth rates are directly related.

Furthermore, section A3 shows direct relationship between the electricity sub-sector share in GDP (%) and carbon dioxide emissions from electricity heat per kWh (CO₂ kWh). In 2001 when the percentage share electricity of Nigeria GDP increase from 0.30% in 2000 to 3.30% the CO₂ kWh also increase from 11.70g to 12.5g within the same period, conversely when the share of electricity reduce from 3.50% in 2005 to 3.40 in 2006; Co2kWh also reduce from 11.2g to 9.9g in the same period.

Table 3:1 Shows Four Economic Indicators (Entrepreneurial Gains) and Their Respective Environmental Impacts Compared

Year	A1		A2		A3		A4	
	Forest Shares in GDP ¹ (%)	Forest Growth Stock (sq)	GDP Growth Rate (%)	CO ₂ /GDP ² (kg)	Electricity Share in GDP (%)	CO ₂ /kWh ³	Oil Refining Share in GDP (%)	SO ₂ /GDP ⁴ (kg)
2000	0.78	-2.10	4.89	43.30	0.30	11.70	0.06	26.10
2001	0.73	-2.10	4.72	41.30	3.30	12.50	0.16	28.90
2002	0.61	-2.00	4.63	37.80	3.10	11.50	0.12	35.00
2003	0.55	-2.00	9.57	42.30	3.30	12.30	0.12	39.30
2004	0.54	-2.00	6.58	44.80	3.50	11.10	0.12	45.50
2005	0.53	-2.00	6.51	44.70	3.50	11.20	0.12	53.60
2006	0.53	-1.90	6.03	48.00	3.40	9.90	0.13	53.60
2007	0.53	-1.90	6.45	50.40	3.40	9.50	0.13	53.60
2008	0.53	-1.90	6.41	49.20	3.30	9.90	0.14	53.60
2009	0.52	-1.80	7.00	57.60	3.20	9.60	0.14	53.60
20010	0.52	-1.80	7.90	57.60	3.00	9.60	0.14	53.60
2011	0.51	n.a ⁵	7.43	60.00	2.90	n.a	0.13	n.a
2012	0.50	0.00	6.58	57.60	2.79	9.55	0.13	53.64

Key : ¹GDP at 1990 constant basic prices, ²carbon dioxide (CO₂) emissions per GDP in kg, ³carbon dioxide (CO₂) emissions per electricity generation per kilowatt-hour (kWh), ⁴Sulfur dioxide (SO₂) emissions per GDP, ⁵ Not available. **Source:** (i) CBN, (2012, December) Statistical Bulletin. Vol. 19. Abuja; (ii) NBS; 2013; and (iii) EPI 2000-2012

Finally, the last section shows the percentage share of oil refining in the real GDP of Nigeria economy

and sulfur dioxide emissions per GDP measure in grammes (SO₂/ GDP). Oil refining sub-sector of manufacturing industry in Nigeria economy and has a steady growth in term of its percentage share within the observed years except in 2011 and 2012. The SO₂/GDP in these periods also increases continuously even with reduction in oil refining in terms of percentage share of GDP.

IV. Materials and Methods

The research study employed econometrics method. Based on the literature reviewed and the theoretical framework, this section is preoccupied with the methodology of the research by formulation of models to capture the relationship between the pollution being tested, carbon dioxide (CO_{2t}) emission and entrepreneurship variables from 2000-2012. The use of The CO_{2t} as a proxy for environmental sustainability is discussed in Hoffmann et al. (2005). The use of Co integration Regression (COINTREG) or Fully Modified Least Squares (FMOLS) method is employed to estimate the parameters given the small sample.

The model is explicitly stated as:

$$CO_{2t} = \beta_0 + \beta_1 X_t + \beta_2 X_t^2 + aZ_t + \epsilon_t \dots \dots \dots (1)$$

Where:

- CO_{2t} = the level of pollution being tested i.e. Carbon dioxide emissions per real GDP (to proxy environmental sustainability)
- X_t = Per capita income/GDP growth rate at period one
- X_t² = Ht = Per capita income/GDP growth rate at period two
- Z_t = a matrix of explanatory variables including percentage share of service sector of the GDP (St).
- β₀ = autonomous function of total carbon dioxide emissions per real GDP
- β₁ = Parameter estimate representing total impacts of GDP growth rate in the first Period on environmental sustainability in Nigeria
- β₂ = Parameter estimate representing total impacts of GDP growth rate in the second Period on environmental sustainability in Nigeria
- B₃ = Parameter estimate representing total impacts of service sector growth as a percentage of GDP on environmental sustainability in Nigeria
- ε_t = Error term

In a more explicit form, the models can be written in a log-linear form to transform the variables into the same unit and base. Thus:

$$\ln CO_{2t} = \beta_0 + \beta_1 \ln G_t + \beta_2 \ln H_t + \ln \beta_3 \ln S_t + \epsilon_t \dots \dots \dots (2)$$

The theoretical expectations for the model are as follows:

Positive sign in β₁, given the direct relationship between lnCO_{2t} and lnG_t; Also, negative sign in β₂ given the Environmental Kuznets Curve (EKC) postulation and negative sign in β₃ given that the service sector emits less pollution.

4.1 Presentation of Empirical Results and Analysis

In order to check the time series properties of the data used in the estimation of the model, both the stationarity and co integration tests were conducted to avoid spurious regression results.

The results of the unit root test are presented in table 1. Both the ADF and PP results indicate that only St was found to be stationary at first difference [I (1)] at 5% critical value while CO_{2t}, G_t and H_t are stationary at levels. The test was considered at both intercept and trend.

4.1.1 Unit Root Test

Table 1: The Unit Root Test for Stationary

Variable	ADF Stat	T-Value	Critical Value	Order of Integration	PP	Critical Value	Order of Integration	Included in the Test Equation
lnCO _{2t}	-5.2218	5% = 3.93336	-	I(0)	-7.8696	5% = -3.9334	I(0)	Intercept & Trend
lnGDP _t	-3.3269	5% = 3.1754	-	I(0)	-5.6406	5% = 3.9334	I(0)	Intercept & Trend
lnH _t	-3.3268	5% = 3.1754	-	I(0)	-5.6340	5% = 3.9334	I(0)	Intercept & Trend
lnS _t	-3.9871	5% = -3.4608	=	I(1)	-4.5975	5% = 4.0082	I(1)	Intercept & Trend

Source: Author's computation using Eviews7 econometric soft ware

The long run relationship among the variables was also examined using Johansen co integration framework. The co integration test from both the trace statistic and maximum Eigen value indicate that there is one (1) co integrating vector equation that exist in the system at 5% level. It can then be inferred that a long run

relationship can be found between carbon dioxide emission and its determinants in the system. The Johansen Co integration test results are reported in table 2.0 below.

4.1.2 Co integration Test

Table 2.0: Johansen Co integration Results

Hypothesis No. Of E(s)	Eigen Value	Trace Statistic	5% Critical Value	Max. Eigen Value	5% Critical value	Remark
None*	0.9930	54.0852	24.2760	49.5753	17.7973	Rejected
$r \leq 1$	0.3573	4.5099	12.3209	4.4201	11.2248	Accepted
$r \leq 2$	0.0089	0.08983	4.1299	0.08983	4.1299	Accepted

Trace statistic and maximum Eigen value indicate 1 co integration equation at 5% significant level.

* denotes rejection of hypothesis of no co integration at 0.05 level.

Source: Author's computation using Eviews7 Econometric soft ware.

To examine the causal relationship between Carbon dioxide (CO_{2t}) emission and the entrepreneurship variables, granger causality test was carried out. The results are presented in table 3.0 below.

4.1.3 Causality Test

Table 3.0: Granger Causality Test Results

Null Hypothesis	F-Statistic	Probability-Value	Causal Inference
$\ln G_t$ does not granger cause $\ln CO_{2t}$	0.1721	0.6892	Accept H_0
$\ln CO_{2t}$ does not granger cause $\ln G_t$	0.0273	0.8729	Accept H_0
$\ln H_t$ does not granger cause $\ln CO_{2t}$	0.1721	0.6891	Accept H_0
$\ln CO_{2t}$ does not granger cause $\ln H_t$	0.0273	0.8730	Accept H_0
$\ln St$ does not granger cause $\ln CO_{2t}$	0.3336	0.5794	Accept H_0
$\ln CO_{2t}$ does not granger cause $\ln S_t$	15.4207	0.0044	Reject H_0

Source: Author's computation using Eviews7 Econometric soft ware

Note: rejecting the null hypothesis means that one variable actually granger-causes the other; while accepting the null hypothesis confirms that there is no causality between the variables at 5% level of significant.

The results above indicate that there is no causality between $\ln CO_{2t}$, $\ln G_t$ and H_t while uni-directional causality exists and running from $\ln St$ to $\ln CO_{2t}$. Thus:

$\ln G_t \leftrightarrow \ln CO_{2t}$

$\ln H_t \leftrightarrow \ln CO_{2t}$

$\ln CO_{2t} \rightarrow \ln S_t$

The results of the granger causality test show that two of the independent variables ($\ln G_t$ and $\ln H_t$) have no causality with the dependent variable ($\ln CO_{2t}$) while only St uni-directionally granger causes $\ln CO_{2t}$. The independence of $\ln G_t$ and $\ln H_t$ does not imply lack of relationship. However an individual covariance of $\ln CO_{2t}$ and $\ln G_t$, $\ln CO_{2t}$ and $\ln H_t$ is not zero. The results of estimates are presented in table 4.0 below:

4.1.4 Estimation of Parameters using the Fully Modified Least Squares Method

Table 4: Estimates of the Regression Equation: $\ln CO_{2t}$ Model

Variable	Coefficient	Std Error	t-stat	prob
$\ln G_t$	1506.383	587.7503	2.562964	0.0335
$\ln H_t$	-753.1388	293.9096	-2.562485	0.0335
$\ln St$	1.095943	0.137106	7.986808	0.0000
C	0.646099	0.412267	1.567184	0.1557
$R^2 = 0.921454$	$R^2 \text{ adj} = 0.89199$	F-stat= 31.28372	P(F-stat) =	0.000091
DW = 1.963606				

Source: Author's computation using Eviews7 Econometric soft ware

The coefficient of $\ln G_t$ is positive with high magnitude. This implies a strong positive relationship between per GDP carbon dioxide emissions ($\ln CO_{2t}$) and GDP growth rate in first period ($\ln G_t$). Thus, impacts of entrepreneurship on environmental sustainability are negative and massive. That is, an increase in GDP growth rate due to increase in entrepreneurship activities will also lead to an increase in carbon dioxide emission or environmental degradation. This result is consistent with Riti et al, Riti & Kamah (2015), achieving economic growth sometimes comes with reduction environmental quality.

The coefficient of H_t (GDP growth rate in second period) is negative with small magnitude. This implies that a negative relationship exists between $\ln H_t$ and $\ln CO_{2t}$ that is, when economy is developed, owing to the technical effects, entrepreneurial activities sustain the environment; confirming the U-inverted hypothesis of EKC. The coefficient of $\ln S_t$ (GDP share of the service sector) is positive with large magnitude. This implies strong positive relationship between $\ln CO_{2t}$ and $\ln S_t$. All things being equal, the relationship between the two variables should have been negative or inverse but owing to erratic power supply in Nigerian economy which makes service firms dependent on self-power generators that make use of fossil fuels and emit large sum of $\ln CO_2$. All the coefficients have the appropriate signs and are statistically significant at 5% level using the T-test.

The R^2 (coefficient of multiple determination) shows that 92% variation in the dependent variable ($\ln CO_2$) caused by the joint variation in the independent variables ($\ln Gt$, $\ln Ht$ and $\ln St$) while the remaining 8% variation in $\ln CO_2$ is accounted for by unaccounted factors as captured in the error term. The value of Durbin Watson of 1.9636 indicates the absence of serial correlation in the model.

4.1.5 Residual/ Error Test

Table 5: Testing for the Stationarity of the Residuals/Error

Variable	1%Critical Value	5%Critical Value	Constant& Trend	Conclusion
Residuals/			t-obs	OI Lag
Critical Value	-5.835186	-4.246503	-11.8607(0.0002)	I(1) [1]

Source: Author's Computation using Eviews 7.1 Package

The stationarity of the residuals obtained from the co integration regression of the dependent variable ($\ln CO_2$) of the equation on the independent variables has been tested using the ADF test. The result shown in table 5 revealed that the residual is stationary at first difference of 0.01 significance level. The test included trend and intercept.

4.1.6 Evaluation of the Model

Table 7: Diagnostic Test for $\ln CO_2t$ Model

Diagnostic	Statistic	Conclusion
Ramsey Rest Test	F-statistic = 3.269621 (0.1135) Log likelihood = 0.102048 (0.7494)	Equation is correctly specified
ARCH Test	F-statistic = 0.536310 (0.0.6025) Obs* R-squared = 1.277865 (0.5279)	There is no ARCH element in the residual
Breusch-Godfrey Serial correlation LM Test	F-statistic= 0.022474 (0.9779) Obs*R-squared = 1.424828 (0.9564)	No serial correlation
Multivariate Normality	Jack-Bera test = 1.051903 P-value = 0.5910	Residuals are normal

Source: Author's Computation using Eviews 7.1 Package

To ascertain the evaluation of the model on the basis of econometric characteristics, the diagnostic test and stability test are conducted. Diagnostic test suggests that the model passes the test of serial correlation, functional form mis-specification, non-normality of the errors and heteroscedasticity associated with the model (Stock & Watson, 2010). The Ramsey's RESET test also revealed that the model was correctly specified while the normality indicates that the residuals are normally distributed. Heteroscedasticity is also not a problem.

Figure 1: Stability Test

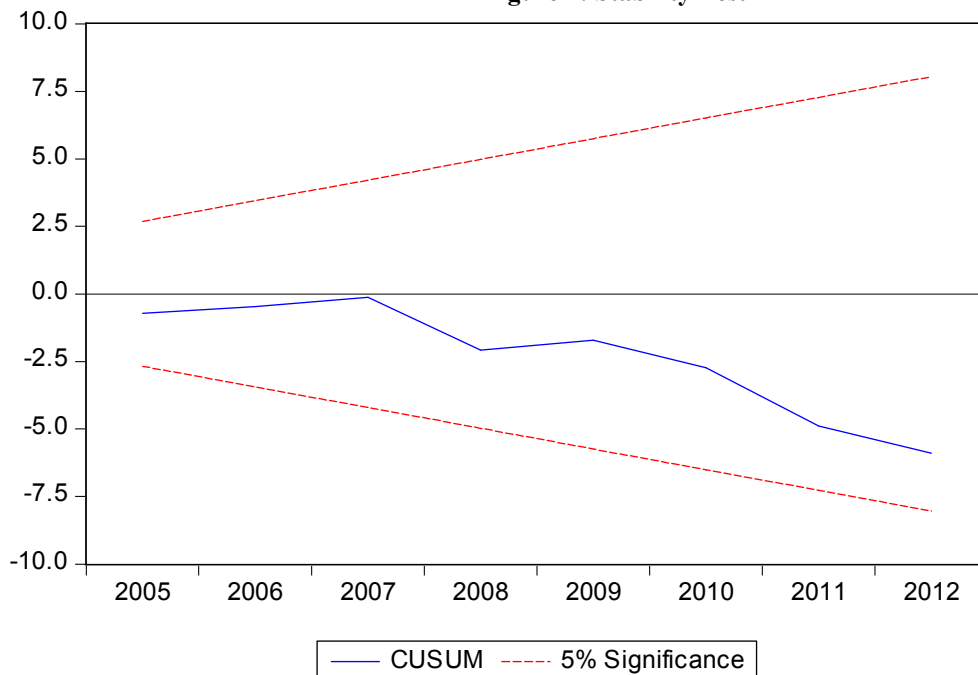


Figure 1 above shows the stability of the model of CO_2 . The figure indicates that the model has been stable since no root lie outside the range of the conditions. The recursive residual test satisfies the stability test at

5% significance level.

V. Conclusion

The major objective of this paper is to examine the impact of entrepreneurship on the environment and how environmental entrepreneurship can be used to sustain the environment for development given that every economy of the world is taken measures to sustain their development for next generations. The *a priori* of this study is that, entrepreneurship has impacts on environmental sustainability in the Nigeria economy. The result of the regression confirms (using per GDP carbon dioxide emissions to proxy environmental degradation, GDP growth rates in two periods G_t and H_t , and GDP share of service sector S_t to proxy entrepreneurship) that entrepreneurship impacts environment negatively in the short run thus making sustainable development unattainable. The finding is in line with the Socio-technical system theory which argues that economic goal should not only be recalibrated like measuring GDP as an indicator of economic performance and social progress but rather, environmental vitality should also be included as indicator in measuring GDP. Thus, goal direction can help to sustain our environment.

It then follows that analysis in section three of this work, that environmentally market failures create opportunities for environmental entrepreneurs in the country is tenable. Therefore, the negative impacts inflicted by entrepreneurial action in the Nigeria economy also create means for environmental entrepreneurship development; this will in turn bring about sustainable development of Nigeria economy.

All the findings support the framework that entrepreneurship has massive impacts on environmental sustainability and that environmental entrepreneurship will boost sustainable economic development. Following the backdrops from the findings above, the paper recommends that policy drivers and entrepreneurs should embark on entrepreneurship activities through taking opportunities in green building, renewable energy, sustainable agriculture, recycling business and green financing created by degrading environment in Nigeria. Policy drivers and stakeholders are advised to embark on policies that restrict carbon intensive products. Similarly institutions need to be strengthened to ensure appropriate abatement measures and adoption of cleaner technologies by entrepreneurs in order to mitigate the rising emission associated with entrepreneurial activities for sustainable development.

REFERENCES

- Anderson, T.L. & Leal, D.R. (2001). *Free market Environmentalism*. Revised Edition. Palgrave Macmillan. New York.
- Anderson, T. L. & Huggins, L. (2008). *Greener than thou: Are you really an Environmentalist? Property and Environment Research Centre*. Hoover Institution Press, Stanford University.
- Bansal, P. Roth, K. (2000). Why companies go green: A model of ecological responsiveness, *Academy of Management Journal*, vol. 43, no. 4, 717-748.
- Central Bank of Nigeria (2012). *CBN Statistical Bulletin*, 2012, Abuja.
- Cohen, B., & Winn, M.I., (2007). Market Imperfection, Opportunity and Sustainable Entrepreneurship. *Journal of Business Venturing* 22(1), 29-49.
- Dasgupta, S., Laplante, H., Wang, B., & Wheeler, D. (2012). Confronting the Environmental Kuznets Curve. *Journal of Economic Perspectives*, 16 (2002), pp. 147-168
- Dean, T. & McMullen, J. (2007), Toward a Theory of Sustainable Entrepreneurship: Reducing Environmental Degradation through Entrepreneurial Action. *Journal of Business Venturing* 22(1), 50-76.
- Folke, C. (2006). Resilience: The Emergence of a Perspective for Social-Ecological Systems Analysis. *Global Environmental Change*, 16, 253-267.
- Goodland, R. (1995). The Concept of Environmental Sustainability. *Annual Review of Ecological and Systematic*, 26(1995), 1-24.
- Grossman, G. M. & Krueger, A. B. (1991). Environmental Impacts of a North American Free Trade Agreement. *National Bureau of Economic Research Working Paper* 3914, NBER, Cambridge MA
- Hisrich, R.D. & Brush, C.G. (1995). *The Women Entrepreneur: Starting, Financing, and Managing a successful new business*. Lexington, MA: Lexington Books.
- Hoffmann, R.; Lee, C.; Ramasamy, B. & Yeung, M. (2005). FDI and Pollution: A Granger Causality Test Using Panel Data. *Journal of International Development*, 17; 311-317
- Holling, C.S. (1973). Resilience and stability of ecological systems. *Annual Review of Ecology and Systematic*, 4, 1-23.
- Holling, C.S., (2001). Understanding the complexity of economic, ecological, and social systems. *Ecosystems*, 4, 390-405.
- Hughes, T., (1989). *The Evolution of Large Technological Systems*. In W. Bijker, T. Hughes & T. Pinch (Eds), *The social construction of technological systems*. Cambridge, MA: The MIT Press, 51-87.

- IBRD (1992). *World Development Report 1992. Development and the Environment*. New York: Oxford University Press.
- Khanka, S.S. (2002). *Entrepreneurial development*. New Delhi: Chad and Company Limited.
- Kuznets, S. (1955). Economic Growth and Income Inequality. *American Economic Review*, 49 (1955), pp. 1–28.
- Kpelai, S.T. (2009). Entrepreneurship development in Nigeria. Makurdi: Aboki Publishers. Low, M.B., & MacMillan, I.C., (1988). Entrepreneurship: past research and future challenges. *Journal of Management*, 14(2), 139-161.
- Meadows, D.H., Meadows, D.L. Randers, J. Behrens, W. (1972). *The Limits to Growth*. Universe Books, New York (1972)
- Meek, R.W., Pacheco, F.D., & York, G.J., (2009). The impact of social norms on entrepreneurial action: Evidence from the environmental entrepreneurship context. *Journal of Business Venturing*, 25(5), 493-509.
- Ministry of Environment (October, 2012). *Great green wall for the Sahara and Sahel initiative- Nigeria Strategy Action Plan*. Federal republic of Nigeria.
- Morelli, J. (2011). Environmental sustainability: A definition for environmental professionals. *Journal of Environmental Sustainability*, 1(2011), 19-27.
- Morelli, J., L. Greenwood, K. Lockwood, & C. Portillo, (2010). “sustainable consumption and production on business: *Sixth Environmental Management Leadership Symposium: From Environmental to Sustainability Management*. 22 Mar.2010, Lenphana Univerty, Luneburg, Germany.
- National Bureau of Statistics (NBS) (2013). *Annual Abstracts of Statistics Facts and Figures about Nigeria*.
- Panayotou, T. (1993). *Empirical Tests and Policy Analysis of Environmental Degradation at different Stages of Economic Development*. Working Paper WP238, Technology and Employment Programme, International Labour Office, Geneva.
- Perman, R. & Stern, D.I. (2003) Evidence from panel unit root and cointegration tests that the environmental Kuznets curve does not exist. *Australian Journal of Agricultural and Resource Economics*, 47 (2003), pp. 325–347.
- Porter, M.E. & Vander Linde, C. (1995). Toward a New conception of the Environment-Competitiveness Relationship. *Journal of Economic perspective*, Vol. 9, No. 4: 97-118.
- Rees, J.I. (1990). *Natural Resources: Allocation, Economics and Policy*. (2nd edn.)Routledge and Kegan Paul, London (1990).
- Rio+20 united nations conference on sustainable development. (2012). Nigeria’s path to sustainable development through green economy. *Country report to the Rio+20 Summit*.
- Riti, J.S & Kamah, M. (2015). Globalization, Economic Growth and Environmental Sustainability Nexus in Nigeria (1981-2013). *Journal of Humanities and social Sciences (IOSR-JHSS)*, Vol. 20, Issue 3. e-ISSN: 2279-0837, P-ISSN: 2279-084, www.iosrjournal.org
- Riti, J.S.; Sentanu, I.G.E; Cai, A. & Shelim, S. (2015). Foreign Direct Investment, Manufacturing Export and The Environment in Nigeria. *International Journal of Development Administration*, Research Centre , National Institute of Development Administration, Thai, Bangkok, Bangkok, 10240, Thailand.
- Ronstandt, R. (1984). *Entrepreneurship*. Dover, MA, Lord Publishing.
- Shrivastava, Paul; Hart, Stuart L. (1995), "Creating sustainable corporations" *Business Strategy and the Environment* 4.3 : 154-165.
- Stiglitz, J.E., Sen, A., & Fitoussi, J. (2009). Report by the commission on the measurement of economic performance and social progress. Retrieved May 20, 2013, from [http:// www.stiglitz-sen-fitouss.fr/document/raport_analysis.pdf](http://www.stiglitz-sen-fitouss.fr/document/raport_analysis.pdf).
- Stock, H.S. & Watson, M.W. (2010). *Introduction to Econometrics (3rd Edition)*. NewYork: Pearson Addison Wesley. Sustainopreneurship: Wikipedia.org
- The Brundtland Report, (1987). Our common future. *World Commission on Environment and Development (WCED)*, Washington.
- Umberto, P. (2012). Resilience and sustainable development: theory of resilience, system thinking and adaptive governance. *European Sustainable Development Network (ESDN) Quarterly Report* No. 26, September, 2012.
- United Nations Development Programme (UNDP) (2012). International Human Development Index (HDI). *Country profile- Nigeria*, Washington.
- Walker, B., & D. Salt, (2006). *Resilience thinking: sustaining ecosystems and people in a changing world*. Washington: Island Press.
- World Commission on Environment and Development (1987). *Our common future*. Oxford: Oxford University Press.

Appendix

Figure 2 C02-GDP Relationship: An Example of EKC in Nigeria

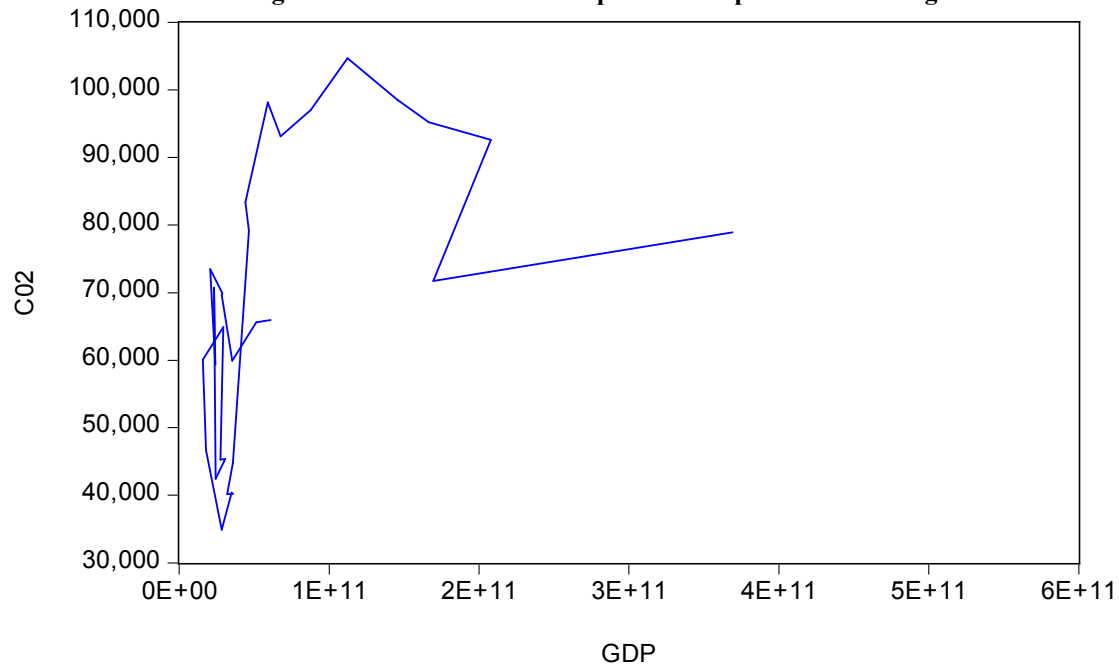
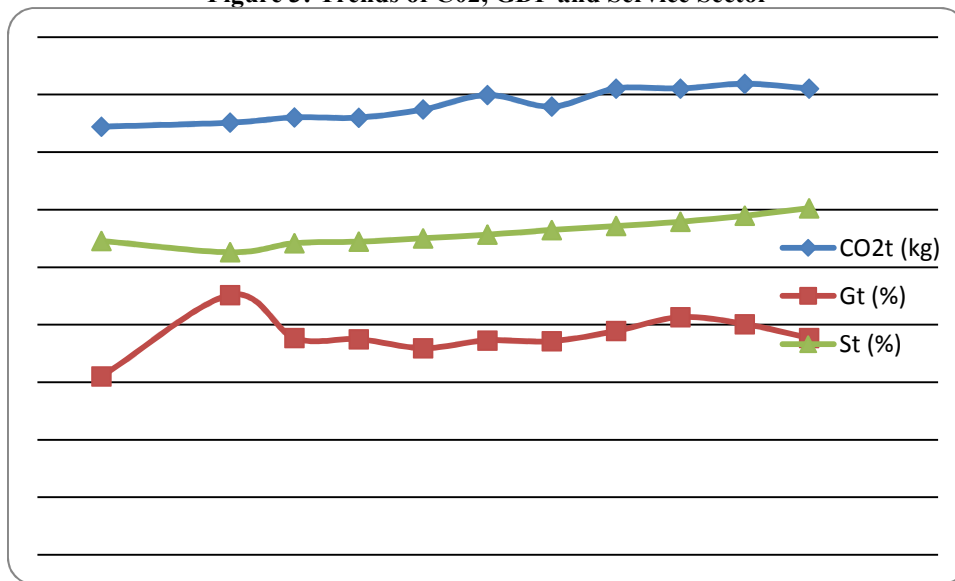


Figure 3: Trends of C02, GDP and Service Sector



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