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Human capital and sustainable development in Nigeria: How can economic growth suffice environmental degradation?

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Abstract
The motivation for sustainable development is universal but strides to achieve it have been mixed in the literature with some schools of thought´s position that economic growth is anti-sustainable development. The crux of this study is to examine the coordinating role (as engine) of human capital among the three pillars of sustainable development in Nigeria from 1981 to 2014 with data from the World Development Indicators (WDI) 2014. Descriptive statistics is used to illustrate observed trend in human capital and the pillars of sustainable development (economic development, social development, and environment protection). Vector Auto-Regression (VAR) econometric technique was used to measure trade-offs, effects, interrelationships, and scenario analysis of these indicators and the prominent role of increased human capital scenario in achieving sustainable development. The analyses of the interrelationship and scenario effects of increased human capital formation showed that environmental degradation negatively affected human capital formation but increases with economic growth. A scenario of further increase in human capital development reduces environmental degradation and increases economic growth in Nigeria. Hence, human capital formation leads to sustained economic growth with reducing environmental degradation.

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CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Development that is sustainable is probably the most frequently used term in development literature in recent times. It is a holistic concept that has attracted global attention because it cuts across all economies. Particularly, Sustainable Development (SD) possesses greater concern for Africa development agenda, along with emerging issues like the impact of climate change, security, employment, education, output, health, poverty, financial. and economic crises is no exaggeration. Different definitions of SD have evolved from time but more often than not, the concept growth, economic development, development, and sustainable development have been used interchangeably. SD is now a household word all over the world, championed by the United Nations, to manage our resources, especially for the sake of posterity in the wake of rising natural and man-made disasters, such as terrorism, cybercrimes, poverty, environmental degradation, population, flood, climate change, business failures, economic recessions, diseases and epidemics, among other.

The word development has come to mean different things to people at different times according to Umo (2007:599). It is a multi-faceted concept that could refer to social, political, economic, legal, administrative, military and technological development, just to mention a few. The United Nations (UN) presumed growth as development but this was evidently proved wrong in the 1960s when developing nations met the UN prescribed 6% growth rate which did not translate to reduction in unemployment, inequality, and poverty. In Seers perspective, development is more than economic growth but he raised a question and argued that development must answer what has been happening to unemployment, inequality and poverty (Seers, 1963 and Umo, 2007)? In the 1970s, the International Labour Organisation (ILO) see development as a process that guarantees the provision of the minimum Basic Needs of man such as food, clothing, shelter, basic education, and health etc. The United

Nation Development Programme (UNDP) in the decade of 1980 conceptualised human beings to the epicentre of development process. Soubbotina (2004) place human beings at the centre of concern for SD entitled to healthy and productive life in harmony with nature. The progress of defining and measuring development from one decade to another have favoured human development towards living a quality, healthy, sufficient and creative life.

SD is a concept first endorsed at the UN General Assembly in 1987 to support development that is inter-generational. The World Bank (WB) see it as development that continues while the Rio Declaration on Environment and Development (1992) opined SD to be long-term continued development of the society aimed at satisfying human needs at present and in the future through rational usage and replenishment of natural resources, preserving the earth for future generations. The most accepted and cited definition of SD is the 1987 Bruntland Commission definition; SD is development that meets the needs of the present without compromising the ability of future generations to meeting their needs. From the concept of SD presented here, it is anchored on economic development, social equity and environmental protection pillars according to United Nation (2007) and Oladeji (2014:12).

A crucial missing factor, baseline setting or ground in which the societal pillars of SD stands; the human capital. Human beings are the greatest wealth and resources of a nation, which coordinates all other resources to achieve sustainable development. Oladeji and Adebayo (1996) considered human capital to be the epicentre of economic development process. Human resources in any process have come to be the most crucial factor that affects the rate of success in other systems, even in an organisational setting (Harry, 2010; Satope, 2012:7 and Ajibade, 2013:5). Fadi (2014:12) found that Taiwan, Hong Kong, and Singapore have become major exporters of a sophisticated range of products (value-added manufacturing activities) attributed to the fast growth rate of human capital accumulation and the attainment of new capabilities. Oladeji (2014) further sees human capital as central piece

for planning long-run economic growth as human capital reflects in every intellectual or theoretical input. Human capital development here is defined according to Harry (2010) as the totality of efforts aimed at developing and grooming of human beings so as to present them fit and qualified to be productive to themselves, in particular, and the society, in general. To Amsalu (2011), it is called the productive base of a given nation consisting of all forms of capital - physical, human, natural and social which the present generation bequeaths to its descendants. This is apparent as UNESCO, a leading agency for the UN Decade of Education for SD identified and seeks to integrate the principles, values, and practices of SD into all aspects of education and learning, as the key to addressing new global social, economic, cultural and environmental challenges (UNESCO, 2014). The centrality of human beings in the epicentre of sustainable development is crucial and the quality of such human resources is believed to be pivotal to meeting the conditions for SD especially in developing nations.

The modern way to secure the future is best securing the educational and health of the people which in turn would propagate the seeds of SD in less developed countries. Human capital in the form of education and health or life expectancy has been found to be correlated with SD. Issues of improving human capital, especially in less developed nations have not been taken up seriously compared to other challenges of the region like security and politics among others. Placing human development (knowledge economy) as priority would give less developed nations what it takes to maximise their abundant endowment to positively empower the people to become competitive with other developed parts of the world.

The most powerful tool in the twenty first century is Knowledge, Information and Skill (KIS). The United Nations estimate showed that knowledge economies account for about 7% of world GDP and it is growing at 10% annually. The UN report showed that 50% of productivity growth in the European Union was considered as a direct result of the use and

production of information and communication technology (Ezzat and Mohamed, 2012, 34). The importance of human capital is reinforced by the dramatic rise over the last decades the role knowledge and innovation play in development. Technology which is using science to solve local and practical societal problems speaks of the huge potential that lies in human capital.

Education occupies a unique role in improving human capital in a multiple ways. It ranges from enhancing productivity and peoples' ability to sustain a livelihood, adopt new technologies, and be better parents and citizens of building the awareness, attitudes, skills and partnerships needed to tackle regional and global development challenges like economic, social and environmental issues (Birger and Ruth, 2013:3). This can manifest in the kind of nursery, primary, secondary and tertiary education besides the available health facilities for the citizens. Government, regional, international Funds and non-profit organisations' efforts in the form of expenditure on education and health, quality of environmental laws including provision of support facilities have been recorded as ways of improving human capital (Bloom et al., 2001and Florian, 2003).

Skill education and sustainable development relationship can be said to be complex and dynamic as education affects all sectors of economy; Agricultural productivity, enhances the status of women, reduce population growth rates, enhance environmental protection, and generally raise the standard of living. For example, literacy and numeracy allow farmers to adapt to new agricultural methods, cope with risk, and respond to market signals. Literacy also helps farmers mix and apply chemicals (e.g. fertilizers and pesticides) according to manufacturers' directions, thereby reducing the risks to the environment and human health. A basic education help farmers gain title to their land and apply for credit and use basic technology for production which in turn boost output.

Countries that do not plan for human development to address not only their current human resource problems but social infrastructure, environment and economic, would find out that the sustainable development gap between them and those that do will continue to be evident (Silva, 1997). This means that economic growth without quality human capital development in such economy will lead to increase output but may not lead to sustainable development (Umo:303, 2007). The environmental Kuznets curve (EKC) hypothesis further buttresses this claim as environmental damage first increases with income (Stern, Common, and Barbier, 2017:1151A). Present production and development that negate or do not plan for environmental protection (pollution, green gas emission and warming of the environment) is not sustainable development. Scientists agree that a doubling of atmospheric CO2 levels could result in temperature increase of between 1.5 and 4.5°C, caused by rapid changes in snow and ice melt, behaviour of clouds and water vapour. However, Panayotou (1993) posits that better enforcement of environmental regulations, better human capital/technology and higher environmental expenditures, result in levelling off and gradual decline of environmental degradation.

Human capital development has been inclined towards developed countries compared to human capital development recorded in less developed countries (OECD, 1996, 3). In fact, significant empirical literature both on country and regional cases, confirmed human capital development and sustainable economic development like the emerging nations (Rosenzweig, 1987). Hence, attention need to be placed not only on economic growth but what happens to environmental protections, sustainable increased production, infrastructure, better transportation network, health care service, education and training management, safe drinking water, equitable with reduced poverty, pollution and unemployment.

Human capital development according to Ajibade (2013) has the potential to offer humanity the recipe to tackle most of the development challenges confronting the world

today. Lack of concerted efforts at different levels (international, national, regional, local, institutional and individual) is a huge issue. Improvements in education coverage, however, must go hand in hand with a major improvement in education quality (Birger and Ruth, 2013, 2).

The Human Development Report of 1996 stated that economic growth is a means to an end (human development). Hence, economic growth in the form of a country's total wealth or output over a period of time can enhance the potential to reduce poverty and solve other social problems and as well lead to human capital development. On the other way round, increase in human capital development may also lead to economic growth or better life through enhanced production function. So, a casual relation between human capital development and sustainable development is envisage whether human capital development is the ground pillar for sustainable development (OECD, 1996, 3; Fadi, 2014). The contribution of human capital development to sustainable development is more in the theoretical realm than empirical. The theoretical contribution of human capital in growth process is very clear. According to Faisal and Abdul (2013) however, empirical findings have been mixed. Temple (1998) did not find human capital to be significant when he applies robustness tests to Mankiw et al. (1992) results. Alege and Ogundipe (2014) found human capital to be significantly contributing to economic growth. There is need for more study to be explored and reveal the dynamics of human capital environmental degradation, and economic growth in Nigeria. Descriptive statistics and Vector Auto-regression (VAR) methods would provide useful information concerning causality, dynamic, effect and relationships of human capital and sustainable development in Nigeria.

2. Literature Review

The review of literature in this study pays much attention on the theoretical perspectives of sustainable development, human capital development, and economic growth.

2.1. Sustainable Development

Sustainable development first appeared in the World Conservation Strategy put forward by the International Union for the Conservation of Nature (IUCN) in 1980 where economic growth was seen as an enemy of environment (Stern, 1997, 146). But prominent meaning of SD is the Brundtland Report (WCED, 1987) proposed that sustainable development is "development that meets the needs of the present generation while letting future generations meets their own needs. In recent years, economists have made progress in articulating their conception of sustainable. Crucial to this is that scholars have been able to synthesized SD into three pillars; economic development, social equity and environmental protection pillars (United Nations, 2007 and Oladeji, 2014, 12).

There are two main criteria of sustainable development; Weak Sustainability (WS) and Strong Sustainability (SS). "Weak sustainability" refers to non-declining total capital (productive base) in the form of physical, human and natural capital. The WS rents from natural resources could be invested (substituted) in manmade capital and/or human capital to ensure sustainable development. Strong sustainability on the other hand, means a threshold level of some forms of capital (physical, human, social, and natural) to be preserved in physical terms. In economic literature, it is the WS criterion that is been employed most widely according to Amsalu et al. (2011, 11) because of scarce resource with alternative uses. Weak sustainability is all about forms of capital that are substitutable for each other. More so, SS requires in addition to WS, the stocks of capital (K) should not be declining. 'addition to' is preferred because a situation in which natural capital is preserved while other forms of

capital are allowed to decline significantly can hardly be called ‘sustainable development’ (Adejumo and Adejumo, 2014).

Tern (1997, 146) stated that there is a consensus among a large number of economists that the weak sustainability supports the capital theory approach (CTA) and is a useful means of measuring sustainability especially in inform policy making (Carson et al., 1994; Steer and Lutz 1993). There are also a growing number of critics who question whether this is a useful way to address sustainability (Common and Norton 1994; Common 1995).

Though the human needs included in the definition is of recent thinking coupled with Soubbotina (2004) and Harry (2010) views that human beings are the epicentre for sustainable development. The criterion of this study is trying to capture sustainable development as much as possible from the weak sustainable development capital approach (productive base) that is substantial to be bequest to next generation with human capital bias, a position Martin (2006, 6) also agreed. Eric (2010) equated weak sustainable development with sustained growth. The productive base consists of all forms of capital assets in a given economy such as; physical (reproducible- manufactured) capital, human capital (skills and knowledge embodied in humans) natural capital (energy, minerals, forests, water, and land). An example is how provision of Air condition (AC) suffices heat caused by high temperature in the daytime.

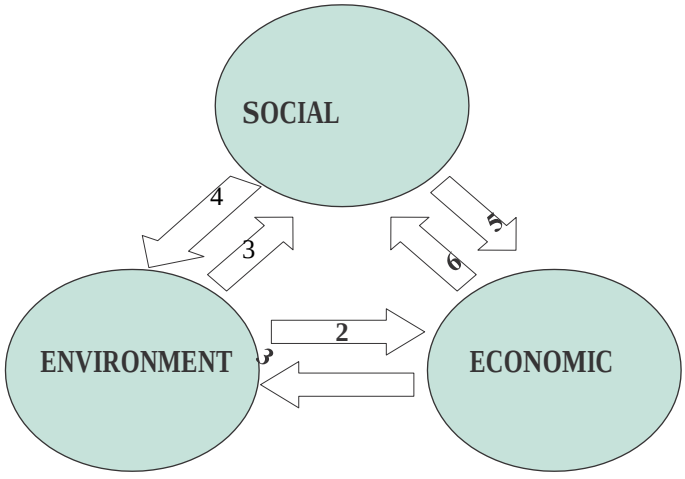

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Figure 1: Dynamics of the Pillars of Sustainable Development

Source: Adopted from Stevens, 2005

Here, the pillars or elements of the pillars of SD are roughly subsumed as productive inputs. These are the inputs of production process that drives any economy to be sustainable development or not and are broadly categorised as; land (all natural resources or capital), labour (energy, person-hours, aspects of 'human capital), and capital (real and working capital, financial capital, manufactured capital etc.) according to Seidler (2000). Most neoclassical economists are of this view especially the famous Cobb Douglas production function in 1928 where he assumed input substitutability factors of production function (Felipe and Adams, 2005).

The interplay of these pillars according to Stevens (2005) as presented according to the arrows in figure 1 is thus;

1. Effects of economic activity on the environment (e.g. resource use and C02 emission).

2. Environmental services to the economy (e.g., natural resources, contributions to economic efficiency and employment).

3. Environmental services to society (e.g., access to resources and amenities, contributions to health, living and working conditions).

4. Effects of social variables on the environment (e.g., demographic changes, consumption patterns, environmental education and information, institutional and legal frameworks).

5. Effects of social variables on the economy (e.g., labour force, population and household structure, education and training; consumption levels, institutional and legal frameworks).

6. Effects of economic activity on society (e.g., income levels, equity, employment)

From the discussion of figure 1, shows that the role of human capital is sacrosanct for

even the ecosystem to survive, economic output, and ensure sustainable development. Good human resource management of the pillars and their interplay as observed is crucial to ensure sustainable development in any economy.

Table 1: OECD CORE SET OF MEASUREMENT OF SUSTAINABLE DEVELOPMENT INDICATORS

Resource indicators: Are we maintaining our asset base?		
1	**Environmental assets**	
	Air quality:	Greenhouse gases (GHG) emission index and CO2 emissions NOx emissions
	Water resources:	Intensity of water use (abstractions / renewable resources)
	Energy resources:	Consumption of energy resources
	Biodiversity:	Size of protected areas as a share of total area
2	**Economic assets**	
	Produced assets:	Volume of net capital stock
	R&D assets:	Multi-factor productivity growth rate
	Financial assets:	Net foreign assets and current account balance
3	**Human capital**	
	Stock of human capital:	Proportion of the population with upper secondary/tertiary qualifications
	Investment in human capital:	Education expenditure
	Depreciation of human capital:	Rate and level of unemployment
Outcome indicators: Are we satisfying current needs?		
Consumption:		Household final consumption expenditure, Municipal waste

	generation intensities
Income distribution:	Gini coefficients (distribution of income among individuals)
Health:	Life expectancy at birth and urban air quality
Work status/ Employment	Employment to population ratio
Education:	Education participation rates

Source: Steven (2005, 3)

2.2. CAPITAL

Capital according to Ivo and Garry (2011) include all forms of assets and capabilities harnessed for human development. It could be natural, biological, financial, and human capital that can be used in production. Natural capital consists of minerals, energy sources and other environmental resources that exist independently of human beings. Biological capital consists of all species of plants and animals that serve as the basis for other life, as well as their by-products and waste-products, like organic content of soil. Human capital includes a wide range of human capabilities: productive resources such as skills and tools; social or organizational resources for governance, commerce, production and education; mental-intellectual resources such as ideas, knowledge, science, technology, and information; cultural and psychological resources including values, customs, way of life, character formation, personality development and individuality.

It is clear capital encompasses so much and natural capital looks like the mother of all even as they interact but human capital is more vital for sustainability. Natural capital is enhanced or destroyed by the impact of biological life forms, like photosynthesis of atmospheric CO2 into O2, which are in turn dependent on human activity and vice versa. Money (Financial capital) can be utilized to make any other resource more useful or

productive but human capital seems to be at the driver seat for sustainability. This implies that the sustainability of human capital is interwoven with the sustainability of all other forms of capital as opined in the capital theory approach (CTA) to sustainable development. This is also implied in the weak and strong type of sustainable development. Should capital as captured above is at least positive and not negative (non-declining productive base), one can infer that there is a weak sustainable development but strong sustainability require non-reducing but in fact consistent and increasing productive base.

3. Research Methodology

The Cobb Douglas production function as in equation 1 below is further augmented with Co2 (environmental degradation) to capture sustainable development in our economic model and emphasis is place on human capital instead of physical capital.

$$Y = F(K\ L) \tag{1}$$

The Vector Auto-Regression (VAR) model is used in this study to determine the dynamic relationship among human capital formation, economic growth, and environmental degradation in Nigeria. The VAR model allows all variables to interact in the system model in providing for causal effects, impulse responses, and forecast variance error decompositions. The ordering of the variables is essential by considering policy variables first before target variables in the Nigerian economy in the respective ordering; human capital formation (HC), gross domestic product (NGDP), and environmental degradation (CO2). Wolde (2015) used Carbon Dioxide Emissions per capita (E) is measured in metric tons per capita represent a proxy for environmental degradation

VAR (j) $$Y_t = \alpha + \phi_1 Y_{t-1} + \ldots + \phi_j Y_{t-j} + \varepsilon_t \qquad (2)$$

Where Y_t is a 3x1 vector of endogenous variables, α is a 3x1 vector of intercepts, Y_{t-j} is a vector of lagged variables (exogenous in the study), with ε_t as the disturbance terms, and ϕ is a 3x3 matrix of coefficients. Equation 2 represented in matrix form to be able to derive the standard VAR representation is thus:

$$\text{VAR(1)} \begin{bmatrix} HC_t \\ NGDP_t \\ CO2_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \begin{bmatrix} \phi_{11} & \phi_{12} & \phi_{13} \\ \phi_{21} & \phi_{22} & \phi_{23} \\ \phi_{31} & \phi_{32} & \phi_{33} \end{bmatrix} \begin{bmatrix} HC_{t-1} \\ NGDP_{t-1} \\ CO2_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} \qquad (3)$$

If the VECM seems pliable, the short-run and long-run relationships among the variables would show how human capital and economic growth relate to affect environment in Nigeria both in the short run and in the long run, the amount each variable accounts for changes in the others through their variance decomposition is also emphasised.

Table 2: Definition of Variables

S/N	Variable	CODE	Definition
1	Economic output	NGDP	value of output in an economy over a period of one year
2	Human Capital	HC	Govt Exp. Education and health
3	CO2 Emission	CO2	CO2 emissions (metric tons per capita)

Source: Author's Compilation, 2017

CO2 was sourced from World Development Indicators of the official website of World Bank (2014) but NGDP and GEHC were sourced from Central Bank of Nigeria (CBN) Statistical Bulletin of various issues

4. Result and Discussion

The econometrics model carried out the following tests; unit root test, lag length selection, co-integration, and diagnostic test of validity, which includes the test for the serial

autocorrelation in the residual. The unit root test showed that NGDP and GEHC were stationary at levels while CO2TONPC was stationary after first differencing. The appropriate lag length was lag one selected by sequential modified (LR) test statistic, Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ) because this lag length produced a stable inverse root of AR characteristic polynomial around its circle. Serial autocorrelation in the residual test indicated no serial correlation among the residuals. A cointegration test for likely long run relationship among the variables indicated no cointegration by both Trace test and Max-eigenvalue test. Hence, an unrestricted VAR model is used in this study and the Impulse Response Function (IRF), Forecast Error Variance Decomposition FEVD), and scenario analysis results are respectively presented below.

The IRF in table 3 shows that human capital formation responses from shock to itself and economic output are positive and the innovation from economic output is dominating. However, the responses of human capital to innovations on environmental degradation are only positive in the short run but become negative in the long run. This indicates that the environment in the long run negatively affects human capital development in the study. This may have resulted from effects of environmental practices that negate human development. For economic output, responses of economic output to innovations on human capital formation were only positive in the short to medium term period but became negative in the long run. Similarly, responses of economic output to shocks on environmental degradation were negative all through the periods except the first period. However, self-innovation positive accounted for economic output in the study. For environmental degradation, innovations to economic outputs positively increased environmental degradations in the short run and medium term periods. However, in the long run period the response of environmental degradation to economic output became negative. This means that economic activities in the country increased environmental degradations in the short run to medium term periods in the

country but eventually started reducing environmental degradations in the long run periods. This is in line with the Kuznet theory (Stern, 2003, 2017b). However, human capital formation and own shock (environmental degradation) negatively influenced environmental degradation in the study both in the short run and long run periods. The IRF table analysis are also pictorially presented in figure 2 below.

The Forecast Error Variance Decomposition (FEVD) of Human Capital (HC) development showed that own shock accounted for most of the effects of human capital development in the short run period followed by economic output and environmental degradation respectively. In the long run, economic output in Nigeria influenced HC development the most in the country followed by own shock and environmental degradation. This reveals that human capital development is mostly a function of economic buoyancy as evident in most progressed economies have high investment in human capital. The FEVD of economic output shows that most of what account for economic growth from first period to the last period are economic output follow marginally by human capital development and environmental degradation respectively. This shows that while human capital development influenced economic growth in the short run, environmental degradation influenced economic output in the long run though marginally.

Furthermore, self-innovations accounted for most of what influenced environmental degradation in the study. The study also reveals that human capital development and economic output further influenced environmental degradation in the study. The influence of human capital development on environmental degradation persists through the entire periods more than the economic output in the study. This shows that human capital development suffices preserving our future than economic output in the study. Investment in education and health can positively influence economic growth in the short run and in the long run influence environmental degradation more than economic output.

Furthermore, a scenario analysis of increased human capital formation to additional 5% of the actual government investment reflected in economic growth positively and environmental degradation negatively respectively. This means that an increase in government expenditure on education and health lead to increase economic output and reduced environmental degradation which can leads to sustainable development in the country as shown in figure 3 and 4 below.

Table 3. Impulse Response Function Table

Period	Response of LOG(GEHC): LOG(GEHC)	LOG(NGDP)	D(CO2TONPC)
1	0.392833	0.000000	0.000000
2	0.248319	0.091910	0.091074
3	0.144024	0.149699	0.024329
4	0.084410	0.184178	0.004801
5	0.048129	0.205151	-0.010426
6	0.026437	0.217937	-0.019003
7	0.013401	0.225825	-0.024278
8	0.005575	0.230773	-0.027456
9	0.000873	0.233957	-0.029395
10	-0.001954	0.236082	-0.030587

Period	Response of LOG(NGDP): LOG(GEHC)	LOG(NGDP)	D(CO2TONPC)
1	0.042092	0.198159	0.000000
2	0.021583	0.209376	-0.021450
3	0.010835	0.216095	-0.023551
4	0.004115	0.220368	-0.026668
5	0.000122	0.223130	-0.028257
6	-0.002287	0.224993	-0.029290
7	-0.003736	0.226316	-0.029929
8	-0.004611	0.227316	-0.030342
9	-0.005142	0.228123	-0.030618
10	-0.005466	0.228814	-0.030811

Period	Response of D(CO2TONPC): LOG(GEHC)	LOG(NGDP)	D(CO2TONPC)
1	-0.003002	0.009158	0.120074
2	-0.016123	0.007274	-0.026880
3	-0.007243	0.003831	0.000655
4	-0.004752	0.002156	-0.002418
5	-0.002777	0.001084	-0.000943
6	-0.001673	0.000452	-0.000620
7	-0.000997	6.99E-05	-0.000331
8	-0.000593	-0.000159	-0.000174
9	-0.000351	-0.000298	-7.66E-05

10	-0.000205	-0.000381	-1.87E-05

Cholesky Ordering: LOG(GEHC) LOG(NGDP) D(CO2TONPC)
Source: Impulse Response Function Table, 2017

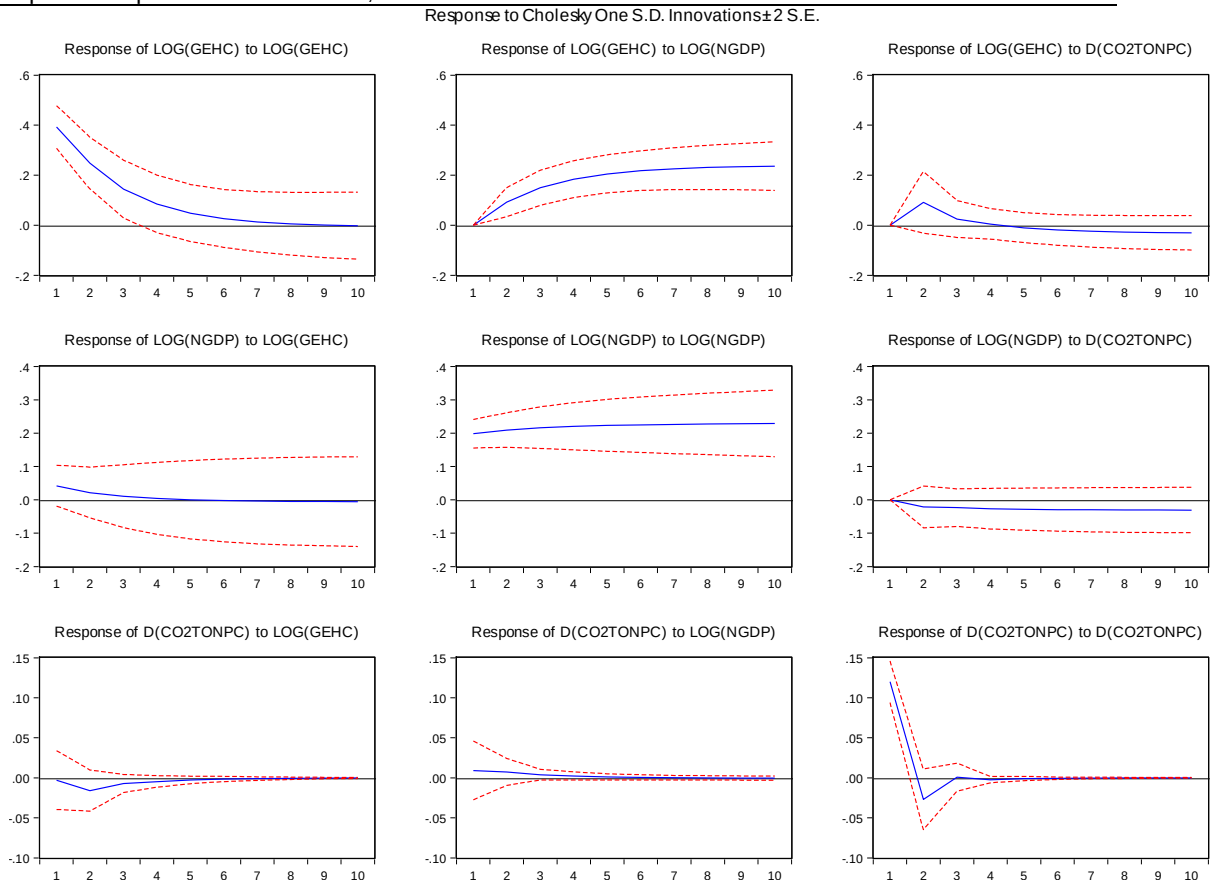

Figure 2: Impulse Response Function Graphs

Source: Impulse Response Function Graph, 2017

Table 4: Forecast Error Variance Decomposition Table

		Variance Decomposition of LOG(GEHC):		
Period	S.E.	LOG(GEHC)	LOG(NGDP)	D(CO2TONPC)
1	0.392833	100.0000	0.000000	0.000000
2	0.482413	92.80602	3.629839	3.564141
3	0.525801	85.62440	11.16131	3.214288
4	0.563504	76.79369	20.40049	2.805814
5	0.601705	67.99213	29.51699	2.490880
6	0.640785	60.12187	37.59387	2.284266
7	0.679979	53.42959	44.41440	2.156007

8	0.718618	47.84436	50.07928	2.076363
9	0.756315	43.19395	54.78046	2.025593
10	0.792898	39.30075	58.70745	1.991804

Variance Decomposition of LOG(NGDP):

Period	S.E.	LOG(GEHC)	LOG(NGDP)	D(CO2TONPC)
1	0.202580	4.317194	95.68281	0.000000
2	0.292921	2.607786	96.85599	0.536224
3	0.364928	1.768351	97.46966	0.761993
4	0.427156	1.299933	97.75413	0.945933
5	0.482750	1.017776	97.89900	1.083224
6	0.533416	0.835451	97.97581	1.188739
7	0.580225	0.710235	98.01902	1.270747
8	0.623920	0.619703	98.04480	1.335495
9	0.665041	0.551414	98.06119	1.387400
10	0.703999	0.498102	98.07226	1.429638

Variance Decomposition of D(CO2TONPC):

Period	S.E.	LOG(GEHC)	LOG(NGDP)	D(CO2TONPC)
1	0.120460	0.062098	0.577992	99.35991
2	0.124684	1.730055	0.879886	97.39006
3	0.124955	2.058608	0.970081	96.97131
4	0.125087	2.198592	0.997740	96.80367
5	0.125126	2.246472	1.004624	96.74890
6	0.125140	2.263858	1.005710	96.73043
7	0.125144	2.270040	1.005670	96.72429
8	0.125146	2.272228	1.005806	96.72197
9	0.125146	2.272981	1.006357	96.72066
10	0.125147	2.273223	1.007271	96.71951

Cholesky Ordering: LOG(GEHC) LOG(NGDP) D(CO2TONPC)
Source: Forecast Error Variance Decomposition (FEVD) Table, 2017

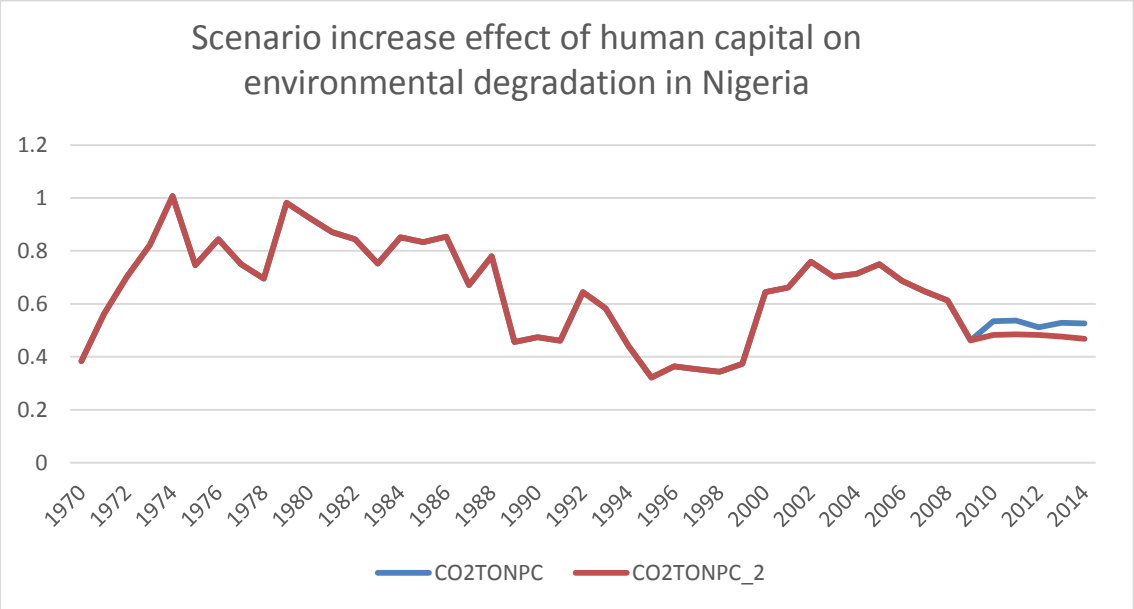

Figure 3: Scenario Analysis of 5% Increased Human capital Formation on Environmental Degradation in Nigeria

Sources: Eviews using VAR Scenario Econometric Technique, 2017

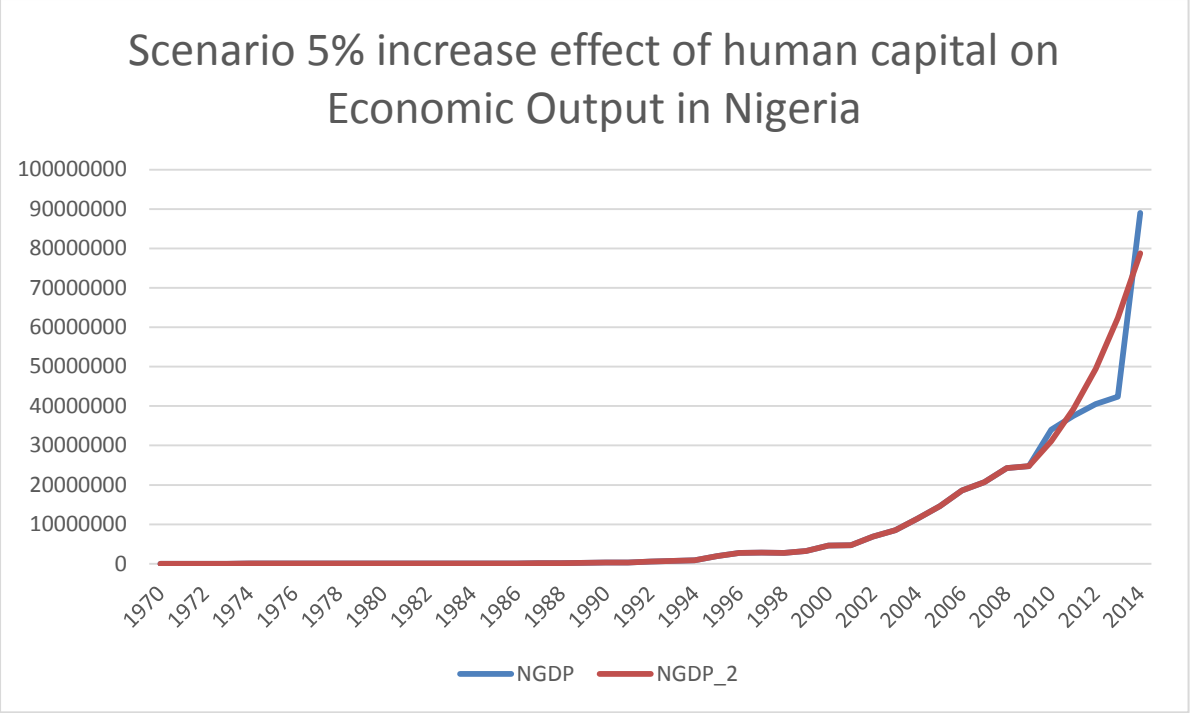

Figure 4: Scenario Analysis of 5% Increased Human capital Formation on Economic Output in Nigeria

Sources: Eviews using VAR Scenario Econometric Technique, 2017

5. Summary and Conclusion of the Study

The study examined the impact of human capital development (in the form of government investment in education and health) on the three pillars of sustainable development in Nigeria. The concept is that human capital development is expected to reduce the effect of economic activities on the environment. The study used a vector autoregressive (VAR) model to investigate the effect and interactions of human capital development, economic growth, and environmental degradation through impulse response function and forecast error variance decomposition results in Nigeria. The study further used scenario analysis of increased human capital development to examine the effect of such increase on economic growth and environmental degradation in the country. The analyses of the

interrelationship and scenario effects of increased human capital formation showed that environmental degradation negatively affected human capital formation but increases with economic growth. A scenario of further increase in human capital development reduces environmental degradation and increases economic growth in Nigeria. Hence, human capital formation leads to sustained economic growth with reducing environmental degradation.

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