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Effect of Sustainable Development Goals and Rural Development in Nigeria: 2000-2021

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Abstract

This study examines the sustainable development goals and rural development in Nigeria, 2000-2021 with the view to appraise the trends of poverty in Nigeria, investigate the effect of sustainable development goals on rural development and determine the causal relationship between sustainable development goal and rural development in Nigeria. Annual data on manufacturing valued added gross, gross primary education, annual current health expenditure, adjusted net national income, access to electricity, and rural development are downloaded from the World Development Indicators (WDI) (2021 edition). The data were analyzed using descriptive statistics and ARDL estimation technique. The appraisal of poverty measured by the adjusted net national income in Nigeria from 2000 to 2021. Adjusted net national income has been unsteady as it kept increasing in 2000-2003 followed by a decrease in 2003 to 2005 and a slight increase in 2005 to 2019 after which it decreased in 2019- 2020 due to the Covid-19 pandemic. The ARDL results revealed that all determinants are not all statistically significant but most variables are jointly significant. Manufacturing valued added gross, annual current health expenditure, adjusted net national income, access to electricity has negative impact on rural development, while gross primary education has positive and significant impact on rural development in the long run. The diagnostic test confirms that all variables used for the model are significant which signifies a strong relationship exist between rural development and other variables used. The study concluded that there is short-run causality between indicators of sustainable development goals used in the study and rural development in Nigeria over the study period.

Keywords: Effect, Sustainable Development Goals, Rural Development, Poverty Level, Nigeria.
JEL Classification: 01, I3, R2.

Introduction

The need for improvement in the living conditions of rural communities is the ultimate objective of all efforts directed at accelerating the pace of development in rural areas. There is a sharp contrast between the rural and urban areas regarding accessibility to essential social services i.e., health care, education, communication, electricity, employment, infrastructural development and quality of life as the rural areas are far behind.

The sustainable development goals (Goal 1, Goal 3 and Goal 9) are the significant indicators affecting the lives of the rural people. The first goal is to end poverty in all its forms

everywhere. This goal can be said to have captured all the other goals since poverty is a multidimensional concept that covers various aspects of human conditions. The third goal is to ensure healthy lives and well-being for all at all levels and the ninth goal is to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The United Nations (2013) reports indicate that, over much of the globe, rural poverty is on the increase. As a predominantly rural society, Nigeria has over 70% of its population in rural areas (Ele, 2006), and it is widespread and severe poverty despite its resources, just as it is widely acclaimed that resource-rich countries are slower in development (Kaznacheev, 2017).

Research has shown that a greater number of the nation's population resides in rural areas, these rural people are poor, hungry, and without health assurance, hence their life expectancy remains very low and also it is seen that they are behind in the achievement of other sustainable development goals. Ogidefa (2010) perceived rural development to involve creating and widening opportunities for (rural) individuals to realize their full potential through education and sharing in decisions and actions which affect their lives. Thus, a focus on the rural people will enhance the achievement of SDGs since rural communities account for more than half of a country's population. If there must be a significant achievement in any programme in a nation, the rural communities must of necessity be carried along. Nigeria is not isolated in this, if the nation will end poverty in all its forms, hunger, achieve food, security and improve nutrition, promote sustainable agriculture and ensure healthy living for all ages, in pursuance of sustainable development goals, then, the integration of her rural communities becomes necessary (Hanachor, & Olumati, 2018).

For instance, federal budgets have depicted this negligence of education in 2007 to 2014 the budget for education has been insignificant compared to other sectors in 2007 what was allocated to education was 12%, in 2008, 10%, in 2009, 11%, in 2010, 9%, in 2011 9.5%, in 2012, 8.43%, in 2013, 10.7%, in 2014, 8.4% respectively (Federal Ministry of Education, 2014). This indicates that education has not been accorded the desired priority in the national budgets as this is far below the United Nations benchmark of 26% minimum for education.

The unavailability of infrastructures according to the SOFRECO Reports 2011, affects productivity and raises production and transaction cost. Since it has long been factored in as a strategy for national development i.e., socio-economic infrastructures such as transportation, energy & power, water, communication, processing technologies, information communications technology (ICT), and education which positively contributes significantly towards economic growth sustainability and in terms of supplying the needed raw materials for industrialization and food for survival in the rural area.

In September 2015, the Heads of State adopted the agenda for sustainable development. This agenda charts out a universal holistic framework to help set the world on a path

towards sustainable development, which was endorsed by 193 nations in New York, is expected to guide nations, international organizations, the private sector, civil society and governments in all countries and at all levels in the shared pursuit of a healthier world and a better tomorrow (Vincent, 2017).

According to the Brundtland Commission report which globally initiates and popularizes the concept. Sustainable development is defined as "Development that meets the needs of current generations without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 45). Below are the 17 sustainable development goals, which show that all have direct bearing or relevance to the rural people. This invariably means that addressing these goals from the perspectives of the rural communities; will result in significant achievement.



Source: www.sustainablegoals.com

Every urban area was at a point called a rural area. This, therefore, means that what differentiates a rural area from an urban area is principally its level of development measured in terms of the availability of social, economic and political institutions. The importance of developing rural areas remained one of the major reasons why various governments have embarked on development projects in communities in the state. Most of these programmes failed to see the light of the day partly because the rural poor were excluded in the policy formulation phase thereby paving the way for the provision of programmes that are not even the major need of the rural communities; hence find it extremely difficult for them to take ownership of such programmes.

Nigeria is in Sub-Saharan Africa. The country is richly endowed with abundant natural resources like petroleum, gas, rubber, cocoa, limestone and other gifts of nature. At present, it is experiencing one of the world's highest economic growth rates averaging 7.4 per cent Central Bank, 2014). Paradoxically, despite these natural resources, the country is

facing the menace of poverty at an alarmingly high rate, especially in the rural areas which have been difficult to eradicate (Eteng, 2016). Rural dwellers in Nigeria are daily confronted with the hurdle of poverty that has made development to be elusive. Reports are showing that SDGs performance has not sufficiently reduced poverty and enhanced rural development in Nigeria. The mid-point Assessment Report (2020) shows that among every ten Nigerians living in rural areas, seven were still living in poverty. Their findings further show that poverty in rural areas is rated at 56.6% in 2015 and 84.6% in 2020 (Chukwuemeka, 2020). Also, Statistics from the National Bureau of Statistics (NBS) show that in 2004, poverty incidence in urban areas was 43.1 per cent, while that in rural areas was 63.8 per cent. As of 2010, the poverty incidence in rural areas increases to 73.2 per cent compared to 61.8 per cent in rural areas. (NBS, 2005, NBS, 2010).

In terms of infrastructural development, the mid-point assessment report of SDGs in rural areas of Nigeria (2020) indicated that infrastructure development such as roads, bridges, hospitals, schools and markets increase from 15.6% in 2015 to 28.6% in 2020 against the target of 90% by 2030. About the potable water supply, reports indicate that the proportion of people with access to safe drinking water declined from 54.0% in 2015 to 41.5% in 2020. In the same vein, the report shows that the proportion of the population with access to basic sanitation dropped from 42.9% in 2016 to 38% in 2020 (The Nigerian Observer, 2020).

The World Bank has shown that poor infrastructure would make a country less attractive destination for investors. This explains the inability of the Nigerian government to attract foreign investors despite endorsing several bilateral agreements and incessant government calls for foreign investors to come and invest in Nigeria. Nigeria is characterized by several cases of inadequate infrastructure. These include the irregular supply of electricity, shortage of pipe-borne water, fuel scarcity, unreliable healthcare service, unstable education institutions, bad roads, malfunctioning ports and erratic telecommunication services amongst other poor infrastructure.

Switzerland was ranked first in terms of having quality infrastructure with a 6.7 value which includes transport, telephone and energy. In Africa, Namibia was ranked first with a 5.3 value, followed by Tunisia with a 5.0 value, South Africa had a 4.8 value ranked 43 in the world and third, in Africa, Rwanda was fourth, with a 4.6 value, while, Nigeria was ranked 120 and 56 in the world and Africa respectively (Pendse 1980, Abosedra, et al 2009).

Generally, on education, over thirty million poor Nigerian children of school age in rural areas were reported to be out of school in 2020 (Omotola, 2020). For example, the National Bureau of Statistics (NBS) (2020) indicate the number of school dropouts in rural areas increase from 42.1% in 2015 to 84.7% in 2020.

This study examined sustainable development goals and rural development in Nigeria. Specifically, the study ascertained the extent to which poverty alleviation, reduction in hunger, quality education, primary healthcare, and gender equality has influenced sustainable development of the rural areas in Nigeria.

But why is sustainable development goals significant for rural development?

Poverty remains a predominantly rural problem, with a majority of the world's poor located in rural areas (Dercon, S. 2009), it is estimated that 76 per cent of the developing world's poor live in rural areas, well above the overall population share living in rural areas, which is only per century, E. Sadoulet, and R. Murgai 2002; Giovannucci, D., et al. 2012:6).

The study will be of immense benefit to the Nigerian government to help understand the essence of the sustainable development goals for the development of the rural economy with emphasis laid on rural development and to also bring out possible solutions to rural areas in Nigeria. In a nutshell, it is essential to check these trends of poor statistics in the best interest of citizens, the country was slow in some goals, and the situation is worse in goals (1, 3, and 9).

This research work will look at a particular aspect of development which is rural development and how it has been influenced by sustainable development goals in Nigeria over the years, the impact of sustainable development on poverty, infrastructure and education is critically examined and this study will cover the period of 2000 – 2021.

This study is therefore an attempt to examine rural development and sustainable development in Nigeria by modelling sustainable development goals and ascertaining the extent to which they have influenced the sustainable development of rural areas in Nigeria. Hence, informed by this problem, the study intends to provide answers to the following questions:

i. What is the trend of poverty measured through adjusted net national income in Nigeria?
ii. What is the effect of sustainable development goals on rural development in Nigeria?
iii. What is the causal relationship between sustainable development goals (SDG) and rural development in Nigeria?

Theoretical Review

The review of existing literature by different prominent scholars to have a wider perspective on how sustainable development goals can be used to tackle rural development issues like poverty, infrastructure and quality education amongst others.

The Elite Theory

The theory was developed and popularized by Vilfredo Pareto (1848–1923), Gaetano Mosca (1858–1941), and Robert Michels (1876–1936). Elite theory is a theory that describes the power relationship in contemporary society. It asserts that a small clique (minority group) composed of members of the political class and the policymaking network hold the most power in a state and they exert substantial power over policy decisions (Awojobi.2014). Elite theory suggests that the success of rural development initiatives might be hindered if elites prioritize their own interests over the broader welfare of rural communities. This could lead to unequal distribution of resources, limited participation of local communities, and challenges in achieving holistic and sustainable rural development. Applying elite theory in

this study shows that elites are a few powerful individuals that are in charge of implementing SDGs policies which are meant to enhance poverty reduction and rural development in Nigeria. The masses and the poor for whom the SDGs programmes are meant are not adequately consulted and are not allowed to take an active part in issues that affect them. In the country, the only negligible elite who finds their way into positions of authority put policies in place for the people. As such, the SDGs programmes on poverty reduction and rural development remain fundamentally defective either in policy conception or their implementation. The consequence is widespread poverty and rural underdevelopment in Nigeria while the negligible cabal amasses the wealth of the country for selfish interest.

Multi-Sectorial Approach

This approach recognizes the interconnectedness of various development factors and aims to create synergies for more effective and sustainable outcomes. In the context of SDGs and rural development, a multi-sectorial approach involves integrating efforts from different sectors like agriculture, healthcare, education, infrastructure, and more, to ensure holistic and comprehensive development in rural areas. The relatively small contribution of agriculture to many rural areas means inevitably that other economic sectors have come to play an increasing role in the rural economy, health, infrastructure, road, recreation and tourism and education has to be given priority in rural development strategy. While it was recognized that multi-sectorial was not a new phenomenon, it gained increased policy relevance. However, as noted by Salisu (2014) the goals of rural development might be pursued more effectively by encouraging ways of reducing poverty and employment which are completely unrelated to a single approach. A multi-sectorial approach in Nigeria can help achieve (SDGs) by addressing various interconnected challenges in rural development such as poverty, healthcare, education, and infrastructure which can enhance rural livelihoods, improve access to basic services, and promote overall sustainable development. This approach ensures that progress in one sector positively impacts others, leading to more comprehensive and lasting development outcomes.

Bottom-up Approach

Robert (1983) was among the profounder of the bottom-up model, the bottom-up approach is the opposite of the top-down approach in which the local people initiate the planning. The approach emphasizes involving local communities in decision-making and development processes and could empower communities to address their unique challenges, prioritize needs, and implement initiatives that align with the SDGs. By engaging local stakeholders, such as farmers, women's groups, and village leaders, in designing and executing development projects, Nigeria can achieve more targeted and effective outcomes, leading to improved livelihoods, environmental protection, and overall sustainable rural development.

Integrated Rural Development (IRD)

Integrated rural development theory emphasizes the holistic and coordinated approach to addressing multiple aspects of rural communities, such as economic, social, and environmental dimensions. This theory aligns with the Sustainable Development Goals (SDGs) as they also advocate for a comprehensive and interconnected approach to development, and by promoting inclusive growth, reducing poverty, ensuring food security, improving healthcare, education, and infrastructure, all of which contribute to sustainable development in rural areas. The theory is widely upheld and favored by international development agencies and donors like World Bank and United Development Programme (UNDP). It is integrated in the sense that as opposed to central development, it is controlled and managed locally, but as opposed to local development besides local resources it also leans on the professional and financial support of the center (Ruttan, 1984). This approach considers economic, social, environmental, and cultural factors to create sustainable and balanced growth. It often involves combining various strategies such as agricultural development, infrastructure improvement, healthcare, education, and local governance to uplift rural areas and enhance the quality of life for their residents. In other words, integrated rural development could be called the theory of the new rural development paradigm which tries to identify how local development, and/or their configuration of rural resources can be helped by the center for the benefit of rural localities at the same time maintaining rural values for the future. This is why its integration into the plans and policies of the government will not only lead to the achievement of sustainable development goals (poverty, health, infrastructure & education); but will reposition the nation's economy.

Basic Resource Theory

Basic resource theory emphasizes the equitable distribution and access to essential resources like food, water, healthcare, education, and income. Essang (1975) reported that the development of these resources attracts investment capital to these areas and increases income and employment. The endowment of resources in a given region or locality plays a crucial role in the area's overall development of the area. The availability of this valuable asset in an area helps to improve the quality of life of the people. This theory is closely related to the sustainable development goals (SDGs) set by the United Nations, as many of the SDGs aim to address these same resource-related challenges. Below are few of them:

SDG 1 (No Poverty): Ensuring access to basic resources can help alleviate poverty in rural areas by improving income levels and living conditions.

SDG 3 (Good Health and Well-being): Access to quality healthcare, clean water, and sanitation contributes to improved health outcomes and well-being in rural communities.

SDG 4 (Quality Education): Basic resource availability supports access to education, which is crucial for empowering rural populations and enabling economic growth.

SDG 6 (Clean Water and Sanitation): Ensuring clean water sources and proper sanitation facilities is vital for health, agriculture, and overall well-being in rural areas.

By implementing policies and programs that align with basic resource theory and the SDGs, Nigeria can work towards achieving sustainable rural development, addressing poverty, improving living conditions, and promoting overall well-being for its rural population.

The Solow Growth Model

This theory modelled by Robert Solow (1956) follows the conventional neo-classical growth theory which postulates that economic growth, will depend on population growth (g), saving (s), and knowledge (or effective labor) (A). We can consider how the model's principles influence policy decisions. For instance, investments in human capital and infrastructure align with the goals of improving education and healthcare (SDGs 3 and 4), while fostering innovation can contribute to sustainable economic growth and reduced inequalities (SDG 8), the model's also focuses on how capital formation could guide efforts to enhance agricultural productivity and create employment opportunities, promoting inclusive economic growth and poverty reduction (SDG 1).

Labor Force: The rural population and workforce contribute to the labor input in the model. This can involve efforts to enhance human capital through education and skills training, which would lead to higher productivity and economic growth.

Physical Capital: Investment in rural infrastructure, such as roads, energy, and technology, corresponds to the physical capital in the Solow model. This can improve productivity and stimulate economic growth in rural areas.

Technological Progress: Advancements in agricultural technology and innovation can lead to increased output and efficiency, which align with the technological progress factor in the Solow model. Natural Resources: The model doesn't explicitly account for environmental factors, but sustainable rural development should consider the responsible use of natural resources to ensure long-term viability.

By incorporating these elements into the Solow Growth Model, policymakers and economists can better understand how investments in rural infrastructure, education, technology, and sustainable resource management can lead to balanced economic growth and contribute to achieving SDGs, particularly those related to poverty reduction, food security, and economic opportunity in rural areas. The labour force growth under the Solow growth model requires strategies that address population dynamics including access to education (gross primary enrolment), and healthcare facilities.

Literature Review

The issue of rural development is sometimes looked at from a poverty alleviation perspective. In this regard, Shaheed (2010), undertook a study titled 'Poverty situation in Nigeria an overview of rural development'. The study perceived rural development from the poverty alleviation perspective where he asserts that Nigerian rural development involves many government agencies, and these agencies make policy, manage rural development, maintain infrastructures, channels fund to non-farm activities, sell input and carry out other

activities in the rural sector and yet the issue of rural poverty remains a problem in Nigeria as 70% of the population are poor and mostly ruralites.

Adejumo and Adejumo (2014) investigated the prospects for achieving sustainable development through the millennium development goals in Nigeria using content analysis of previous literature. The study posits that poor economic and social development are the main challenges to achieving sustainable development through the millennium development goals in Nigeria.

Kamar, Lawal, Babangida and Jahun (2014) examined rural development in Nigeria: problems and prospects for sustainable development using the content analysis technique. Findings revealed the failure of previous administrations in the development of rural areas in Nigeria due to poor and no coordinated governance as a major problem stagnating rural development in Nigeria.

Awojobi (2014) investigated sustainable rural development in Nigeria within the context of the millennium development goals using content analysis. Findings revealed MDG will be unable to meet up with the challenge of increasing poverty, infrastructure deficiencies and a high level of illiteracy rate before the termination of the project in 2015.

Ahmad and French (2011) in the analysis of human capital and economic growth coined an issue termed "horizon problem" as regards developing economies. This concept emanated from the timely returns of educational investments in (short-run or long-run) tackling developmental issues like unemployment, low-income levels and productivity. Therefore, Ahmad and French (2011) argued that while concentrating some resources on minimum or basic education, exploring alternative investment options that will bring quick returns that could address developmental challenges could be a worthwhile framework for developing economies, instead of concentrating resources on higher education.

Adenipekun (2013) review sustainable rural infrastructural development in Nigeria within the context of Vision 20:2020. The Second National Development Plan period 1970-74 marked the beginning of national and academic agitation for rural infrastructural development for accelerated national economic development growth. Realizing the gap between rural-urban sectors, successive governments in the country began to put various programs in place to meet both the national and international goals of human and capital development. Toward this goal, a study was recently carried out to x-ray the position of the rural infrastructure in South-West, Nigeria with a view to proffering sustainable strategies for rural development in the country

Iwala (2014) investigate achieving sustainable poverty reduction and rural development in Nigeria through local economic development strategies. Embracing local economic development strategies which focus on local issues through interaction among the spectrum of local communities, local businesses, government, labour, NGOs and the poor, Nigeria and indeed other developing countries can achieve more coordinated and efficient economic growth and development that could significantly and sustainably reduce poverty and fast-track rural development. That is local economic development strategies, a participating process in which local people from all sectors work together to help create

decent jobs and improve the quality of life for everyone, including the poor and marginalized as the most potent tool for achieving sustainable poverty reduction and rural transformation in Nigeria.

Akpa (2008) observed that the fight against corruption is the key to meaningful rural development in Nigeria. He asserts that; the truth of the matter today is that Nigeria is a classical study of lawlessness, recklessness in all forms, high infrastructure decay, and moral bankruptcy. Extreme poverty, hopelessness, and so on and on, hardly would any rational person witness this level of societal decay and not call for a total war against official corruption, a call for a revolution or change necessary to replace evil with good, a shift in paradigm from a politics of self-service to one of public service in its real sense and indeed from the poverty of character to a regime of discipline, integrity and justice. The study revealed that corruption has a grave and devastating impact on the lot of Nigerians dwelling in rural areas. It also indicated that official corruption in Nigeria is known to have dealt lethal blows on the following aspects of community life. Wealth and employment creation are the cornerstone of rural development, a study by Agagba, (2008). The effect of corruption on rural development is devastating as a substantial amount of money meant for rural development is diverted for selfish individual use which is detrimental to rural development. Until and unless corruption is wipe-out in all in all aspects of government business, the quest for rural development will remain an illusion.

The above reviews existing literature, examining the relationship between sustainable development goals and rural development in Nigeria. Although; there exist several attempts by scholars to examine poverty in rural development to the best of my knowledge, no previous study has been conducted on how sustainable development goals can be used to solve rural development problems such as rural poverty, education and inadequate socio-economic infrastructure like electricity, good roads, quality healthcare, good water etc. which is why rural areas are still lagging behind in terms of development in Nigeria. This study aims at focusing on the major components which are poverty eradication, quality education and infrastructural development and not only on poverty that other studies have focused on.

Research Methodology

This section provides relevant information on the research methodology adopted for this study. The chapter concentrates on the theoretical framework, model specification, and definition of variables, techniques/methods of analysis, measurement of variables and sources of data used. The chapter aims to show the link between sustainable development goals and rural development in Nigeria using the time period of 1981 to 2021. The rural sector of Nigeria plays a vital role in the socioeconomic development of the nation.

Theoretical Framework

The Solow growth model of economic growth serves as the foundation for this study's theoretical framework. The Solow growth model developed by Robert Solow focuses on the relationship between capital accumulation, labour force growth and technological progress in explaining long term economic growth while the model primarily addresses economic growth, it can be applied to understand aspects of sustainable development including rural development in Nigeria.

This model provides a condensed view of the economy as a whole and aids in providing insight into the factors driving economic growth and wealth disparities between nations. A dynamic model called the Solow model is based on the neoclassical aggregate production function.

The theoretical model can be stated as:

Y(t) = f [K(t), A(t), L(t)] ..... (1)

The Solow model focuses on four variables: output (Y), Capital (K), labour (L), and "knowledge" or the effectiveness of labour (A). At any point, the economy has some of amount of capital, labour and knowledge. These are combined to produce output.

Model Specification

The variables to be analyzed that were drawn from the model are; poverty headcount ratio at national poverty lines (% of population), primary education of pupils, current healthcare expenditure per capita, and access to electricity (% of population in Nigeria) to measure rural development.

The functional relationship between rural development and sustainable development goals is shown below:

RD = F (LNADNNI, MVAG, GPE, LNHE, LNATELEC)

The economic model to be used in this project work is designed to test the hypothesis of whether sustainable development goals have any influence on rural development. The independent variables were extracted based on five (5) goals out of the 17 goals of the sustainable development. The mathematical equation of the variable to be used for this model is stated as follows:

$$RD_t = \alpha_0 + \alpha_1 LNADNNI_t + \alpha_2 MVAG_t + \alpha_3 GPE_t + \alpha_4 LNHE_t + \alpha_5 LNATELEC_t$$

..... (2)

α_0 =constant term

$\alpha_1 - \alpha_5$ = elasticity of sustainable development goal one as a proxy by adjusted net national income (LNADNNI), manufacturing value added (MVAG), gross primary education (GPE), current health expenditure (LNHE) per capita, and access to electricity (LNATELEC) % of the population of Nigeria.

The econometrical model form of the model used for the data analysis is:

$$RD_t = \alpha_0 + \alpha_1 LNADNNI_t + \alpha_2 MVAG_t + \alpha_3 GPE_t + \alpha_4 LNHE_t + \alpha_5 LNATELEC_t + \mu_t$$

..... (3)

RD_t = Rural development

$LNADNNI_t$ = Natural log of adjusted net national income
$MVAG_t$ = Manufacturing value added gross
GPE_t = Gross primary education.
$LNHE_t$= Natural log of health expenditure per capita.
$LNATELEC_t$= Natural log of access to electricity (% of population of Nigeria)
μ_t= Stochastic error term

A Priori Expectation

Based on the explanatory variables above, it is expected that poverty, primary education, current health expenditure per capita and access to electricity affect rural development. A positive relationship is expected between rural development (RD) and adjusted net national income (LNADNNI), which implies that the higher the adjusted net national income, the higher the rural development (α_1> 0). Also, a positive relationship is expected among gross primary education (GPE) pupils, health expenditure per capita (LNHE), access to electricity (LNATELEC) (% of the population of Nigeria) and sustainable development (α_3, α_4, α_5 > 0), there exists a positive relationship between manufacturing value added (MVAG) and rural development (α_2 >0).

Techniques of Analysis

In carrying out this research, descriptive analysis was made use of to properly examine the pattern of poverty, infrastructure, education and healthcare. The ARDL would be used to show the effect of these variables on rural development in Nigeria and the pairwise Granger causality test is used to test the causality between sustainable development and rural development.

Description and Measurement of Variables Rural Development: Laah et al. (2013) define rural development as the product of various quantitative and qualitative changes in the midst of a rural population and whose converging impacts indicate, in time, an increase in the standard of living and favorable changes in the way of life of the people concerned. Rural development will be measured by poverty (% population), primary education (pupils), current health expenditure per capita, and access to electricity (% of the population of Nigeria).

Access to Electricity: The access to electricity according to World Bank is defined as the percentage of population with access to electricity and it is measured by the population of Nigeria with access to electricity.

Primary Education: Basic education refers to formal, non-formal, and informal public and private activities intended to meet the basic learning needs of people of all ages and the indicative measurement as the gross primary education.

Poverty: Poverty is defined as the state or condition where people and communities cannot meet a minimum standard of living because they lack the proper resources and it is measured by the adjusted national income in Nigeria.

Health Expenditure: Health expenditure includes all expenditures for the provision of health services, family planning activities, nutrition activities and emergency aid designated for health, but it excludes the provision of drinking water and sanitation and it is measured by the current health expenditure in Nigeria.

Manufacturing Value Added Gross: it is the total estimate of net output of all resident manufacturing activity units determined by adding outputs and subtracting intermediary consumption as measured by the gross manufacturing value added in Nigeria.

Types and Sources of Data

All the Research data employed for this study are secondary data. This study covers a period of 21 years (2000-2021) in investigating the relationship between sustainable development goals and rural development in Nigeria. Secondary data will be utilized for this study. Data to be used are downloaded from the World Development Indicators (WDI) (2021 edition) for manufacturing valued added gross, gross primary education, annual current health expenditure, and adjusted net national income, access to electricity, and rural development. The annual data used in this study ranges from 2000-2021.

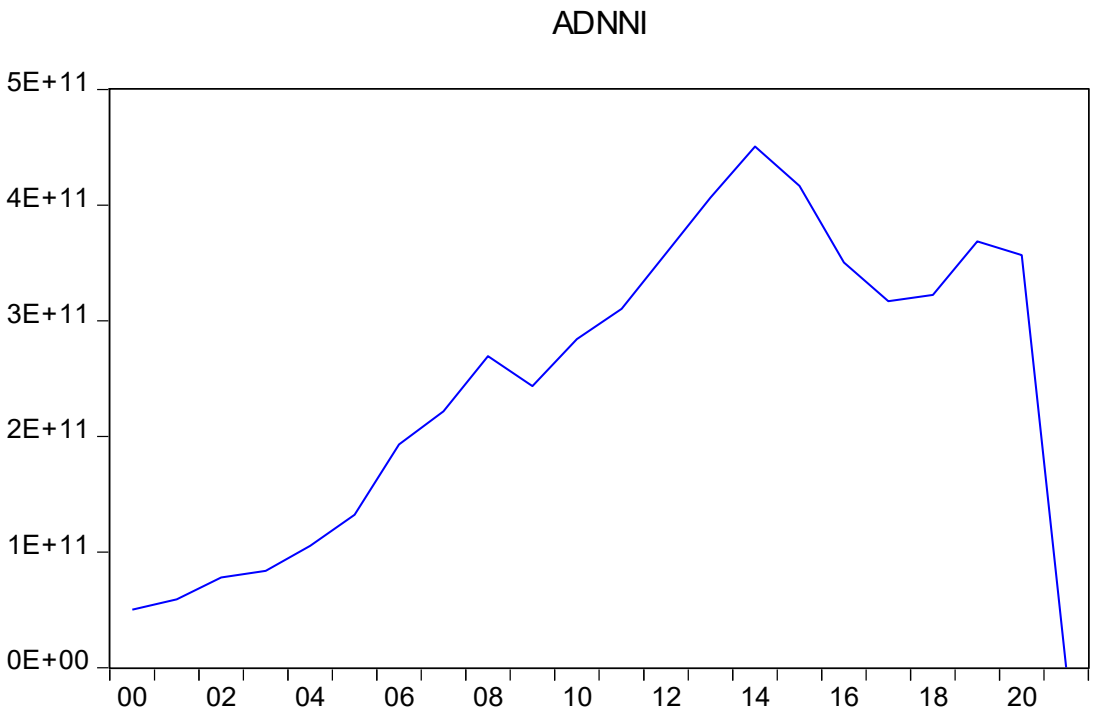
Analysis of Data and Interpretation of Results

This section shall take us through the presentation of data, interpretation of results and discussion of the research findings. The study employs descriptive statistics, correlation matrix, the Augmented Dickey-Fuller (ADF) unit root test and the Johansen co-integration test to examine the time series properties of the variable employed in the study. Also, results and interpretation of the short run vector error correction estimates was presented for the effect of sustainable development on rural development. Finally, the direction of causality was examined between sustainable development goals and rural development. The three objectives of this research were treated.

To achieve the first objective, we carried out the trend analysis of adjusted net national income representing poverty and Section 4.1.0 captures the achievement of this objective while section 4.6 and section 4.7 capture the achievement of the second objective both in the short run and in the long run. And finally, section 4.10 captures the achievement of the third objective which test for the existence of short run causality between sustainable development and rural development. We proceed to show how each of the objective would be achieved starting from the trend analysis.

Trend Analysis of Adjusted Net National Income (ADNNI) as a Measure of Poverty in Nigeria (2000-2021)

A large increase was observed in adjusted net national income from 2000 to 2003 from fifty billon and one hundred million to eighty-three points seven billion dollars according to World Bank development indicators for year 2003 adjusted net national income of Nigeria in United state dollars. What could be the cause of this significant increase in gross domestic product from 2.8% to 3.8% from 1999-2002 according to organization of exporting countries development (OECD, 2003) in addition to that, oil and mining sector as received significant yield during the period. Another reason for this persistent increase from year 2001 to year 2003 is the monetary policy undertaken by the then Central bank of Nigeria. According to a report released by the Central bank on the conduct of monetary policy in year 2003, the broad money supply grew by 24.1% instead of the normal 15% leading to excess liquidity in the system (CBN, 2003), also, bank credit increased by 29.1% compared with the expected 25.7%. Finally, on the reason for the increase in net adjusted national income according to CBN report on the conduct of monetary policy in year 2003 was the increase in gross domestic products growth target from 5% to 15.2%. From the graph, there was a large decrease in net adjusted national income from year 2003 to year 2005 and one reason for this decrease according to Central bank of Nigeria release on the conduct of monetary policy was the low public sector demand for credit in that year another reason for the decrease in adjusted net national income according to premium time release on March 21, 2020 was that of increase debt burden by the Nigerian government as Nigerian debt had gone up to thirty billion dollars mostly borrowed from Paris club of creditors from year 2005 to year 2015, adjusted national income witnessed a slight increase from year this could be as a result of the year-to-year increase in gross domestic products, foreign reserve depletion, increase in prices of domestic prices necessitating the increase in net adjusted national income from year 2015 to year 2016 there was a slight decrease in adjusted net national income from four point one trillion dollars (4,100, 000,000) to three point five trillion dollars what could be the cause of this decrease could be increase in lending rate by commercial bank, decrease in Nigeria export and the cost of the just concluded election as at 2015. From 2015 till year 2019, the adjusted net national income increased upward this would be because of good governance, safe economic environment devoid of risk in that period. Finally, there was a decrease in adjusted net national income from year 2019 to year 2020, this net decrease in adjusted income could be because of the Covid-19 pandemic and its associated consequences on the per capital income of an average Nigerian, another cause for this decrease in year 2020 could be the global financial crisis experienced because of the Covid-19 pandemic and lockdown.



Source: *Authors computation from World Bank Development Statistics (2023)*

Figure 4.1.1: The Trend Analysis of the Adjusted Net National Income (Gross)

In summary, the Nigerian economy experienced more positive increases in adjusted net national income compared to decreases over a long period of time as shown in the graph above.

Descriptive Statistics

The descriptive statistics is employed to describe the statistical properties of the variables in the model. It summarizes the measures of location and dispersion as well as the distribution of the time series data used in the model. The descriptive statistics of time series data shows the descriptive statistics shows that the mean value of rural development has a value of 56.12964 while the mean value of manufacturing value-added growth 3.90692 capturing industry and decent work as one of the goals of sustainable development goals. The mean value of health expenditure is 1.272568 while the mean value of adjusted net national income is 26.08855. The mean value of gross primary education (basic education) in Nigeria from World Bank development indicator is 20955268, while finally on the mean value on access to electricity is 68.78. Below the mean variable is the median, the first median which is based on rural development is 56.07, while manufacturing value added gross is 2.199, the median value of health expenditure is 1.25, while the median value of adjusted net national income is 26.37. The median value of gross primary education is 21836946 while the median value of access to electricity is 83.89. It can be observed that the value recorded for primary education is a gross figure not in percentage. It can also be observed that the highest figure of both mean and median is from gross primary education

or enrollment while the lowest figure is health expenditure. The lowest minimum value of the distribution is manufacturing value added which is negative (-10.80) followed by gross primary education (0) and access to electricity (0) which both have a zero value. The next three highest minimum value after the first aforementioned three are health expenditure (0.9125), adjusted net national income (24.64) and rural development (47.25). While the highest maximum value of the descriptive statistics of the table is gross primary enrollment (28078436) followed by access to electricity which is 87.1 while rural development is the third maximum variable (65.16). The fourth, fifth and sixth lowest maximum variable is adjusted net national income with a value 26.83, manufacturing value added which is 21.797 and health expenditure which is 0.91 in value.

The obtained value for the standard deviations shows that for all the variables used in the descriptive statistics. The observational values given for each of the variable far differs from the mean value obtained from the variable starting from rural development which has a value of 5.6 to gross primary enrollment/education which is 7301837 are not close to the mean value.

The skewness statistic which reveals the symmetric properties of the distribution especially as regards mean and median relevancy reveals that rural development (0.02), manufacturing value added (0.797) and health expenditure (0.26) are positively skewed which implies that the three variables mentioned above have their mean greater than their median while adjusted net national income, gross primary education, and access to electricity with values of -0.9016, -2.15, and -1.64 are negatively skewed and have their median greater than mean.. The kurtosis statistics which reveals the height of the distribution curve reveals that rural development (1.77), adjusted net national income (2.41) and manufacturing value added (2.97) are all platykurtic because the three above all have a kurtosis value less than 3 which also implies that they all have flat tail and low peaked curve, while health expenditure (3.21), gross primary education (6.90) and access to electricity (3.71) are leptokurtic i.e., they have highly distribution peaked curves and lean tails. The Jarque-Bera probability statistics reveals that only four variables out of total six variables which includes rural development, manufacturing value added, health expenditure, and adjusted net national income are normally distributed because those four variables mentioned have a probability value greater than 0.05 while gross primary education and access to electricity are not normally distributed because they have a probability value less than 0.05. All the variables in the study all have observation of about 22 each except from adjusted net national income, and health expenditure which is 21 and 20 respectively.

Table 4.1.2: Descriptive Statistics

STATISTICS	RD	MVAG	LNHE	LNADNNI	GPE	ATELEC
Mean	56.12964	3.906920854	1.272568	26.08855	20955268	68.77818
Median	56.077	2.198511964	1.252631	26.37256	21836946	83.89051
Maximum	65.16	21.79709983	1.620103	26.83387	28078436	87.1
Minimum	47.254	-10.8080365	0.91254	24.63772	0	0
Std. Dev.	5.600084	8.080922092	0.163216	0.689076	7301837	33.21682
Skewness	0.01989	0.796592184	0.23532	-0.90156	-2.14658	-1.64262
Kurtosis	1.765258	2.973607824	3.212746	2.406235	6.900095	3.710547
Jarque-Bera	1.398989	2.327355232	0.222302	3.153329	30.83854	10.35615
Probability	0.496836	0.312335416	0.894804	0.206663	2.01E-07	0.005639
Sum	1234.852	85.95225879	25.45136	547.8596	4.61E+08	1513.12
Sum Sq. Dev.	658.5797	1371.327339	0.50615	9.496527	1.12E+15	23170.5
Observations	22	22	20	21	22	22

Source: Authors computation (2023)

Correlation Matrix

In observing the relationship among the independent variables, correlation analysis was carried out to preclude the possibility of multicollinearity among the variables in the model. Multicollinearity is a condition where two or more explanatory variables in the regression model are highly correlated such that one can linearly predict the other with some degree of accuracy. Table 4.1.3 presents the result from the correlation matrix among the data series with 0.8 as a cut-off point for severe multicollinearity. It can be deduced from Table 4.2 that there was evidence of multicollinearity among relationship of the independent variables used in the model. This is because there was evidence of strongly correlated independent variables with dependent variable in the model. In other words, the correlation values among all the explanatory variables of interest are somewhat above 0.8. The correlation matrix which measures the nature of association between one variable and another variable reveals that manufacturing value added average value has negative relationship with rural development by 0.10 unit decrease in while health expenditure and access to electricity are positively correlated i.e., are positively related to rural development by 0.21% increase and 0.61% increase. Adjusted net national income and gross primary education are negatively associated with rural development by 0.90% decrease and 0.61 unit decrease caused by access to electricity. The correlation table further reveals there is evidence of multicollinearity with values more than 80% degree of association especially

between the independent variable and dependent variable. The correlation table further shows access to electricity, gross primary education, adjusted net national product have positive association with manufacturing value added by 0.17 unit, 0.17 unit, and 0.26% increase. Health expenditure has negative association with manufacturing value added by 0.56% decrease. Gross primary enrollment has positive association with adjusted net national income by 0.79%. Finally access to electricity has negative relationship with gross primary enrollment by 0.57% decreased to correct multicollinearity the one lag of the independent variables might be used.

Table 4.1.3: Results from Correlation Analysis

Variable	RD	MVAG	LNHE	LNADNNI	GPE	ATELEC
RD	1					
MVAG	-0.10376	1				
LNHE	0.214443	-0.56535	1			
LNADNNI	-0.90001	0.264694	-0.106150452	1		
GPE	-0.91481	0.178049	-0.165586582	0.795354	1	
ATELEC	0.615523	0.178332	0.233951246	-0.29535	-0.57274	1

Source: Authors computation (2023)

To achieve the second objective, we investigate the effect of sustainable development goals on rural development using auto regressive distributed lag (ARDL) model but before this can be examined, we first look at the unit root test results, then we proceed to evaluate the vector autoregressive lag length criteria (VAR) to determine the optimal lag length criteria. After this, we evaluated the cointegration status to test for the existence of long run relationship between sustainable development goal and rural development in Nigeria. After this we evaluated the short run error correction model (ECM) to model relationship between sustainable development goal and rural development in Nigeria and long run result using the normal equation to show the relationship between sustainable development goal and rural development in Nigeria.

Unit Root Test

The unit root test was carried out to ascertain the status of the time series data before proceeding to the analysis of the data in line with previously stated objectives to avoid making use of data which are not stationary and to avoid derivation of spurious regression results. To do this, the study employed the Augmented Dickey Fuller (ADF) unit root tests and the result is represented in Table 4.1.4 the units root results reveals that rural development (RD), manufacturing value added gross representing industry and decent work (MVAG), health expenditure (LNHE) and adjusted net national income (LNADNNI) are all stationary at levels I(0) mostly at constant in levels while gross primary enrollment (GPE)

and access to electricity(ATELEC) are stationary at 1st difference I(1) in summary the first four variables are stationary at levels while the last two variables are stationary at 1st difference at 10% only one variable health expenditure(LNHE) or 5% level of significance and 4.3.

Table 4.1.4: Unit Root Test Result

	Augmented Dickey Fuller(ADF)							
VARIABLE		**Levels**		**REMARKS**	**1st Difference**			**REMARKS**
	constant	**constant with trend**	**Critical values at 5%**	**Levels remark**	**Constant**	**constant with trend**	**critical values at 5%**	**final remarks**
RD	-12.5071	-3.07133	-3.658446	I(0)	-1.33253	-0.814245123	-3.658446264	I(0)
MVAG	-3.19935	-3.11176	-3.01236312	I(0)	-6.2324	-6.066449	-3.02068565	I(0)
LNHE	-2.80586	-2.95293	-2.655194315	I(0) @10%	-5.73232	-5.762959	-3.690814	I(0)
GPE	-1.99073	-1.35584	-3.690814	N/S	-1.04207	-3.821973	-3.673616	I(1)
ATELEC	1.990535	0.592657	-3.690814285	N/S	0.913669	-7.181035	-3.690814	I(1)
LNADNNI	-3.73267	0.097913	-3.710482	I(0)	-0.7061	-4.332859	-3.065585	I(0)

Source: Authors computation (2023)

VAR Lag Length Selection Criteria

There is no hard-and-fast-rule on the choice of lag length to be estimated as much as lag length selection criteria is concern. This is because it is an empirical issue. Too many lags in the model can lead to loss of degree of freedom, multicollinearity, serial correlation in the error terms, and misspecification errors. However, the rule of thumb that the number of lags for annual data is typically small (1 or 2), form the basis for the selection of the lag length employed in this study. after performing unit root test and our empirical revealed that our data is stationary at first difference, the next process would be to do co-integration test and VECM, but before proceeding that process, to avoid autocorrelation problem we adopted VAR model, and is crucial for the time series data specification. This study performed the Vector Auto regression (VAR) lag order selection criteria to identify the lag to use for cointegration test, the lag length selection criteria test is shown in table 4. Based on all criterion, long-run test statistics we employed a lag length of k = 1 in determining co-integrating vector among the variables. Thus, in this study, maximum lag of two were estimated. Table 4.1.5 shows the estimates of the various lag using various information criteria. The result in Table 4.1.5 revealed that Akaike information criterion is the best information criterion with lowest values which picked the one (1) lag length as the optimal

lag. While lag 1 will be used for model based on Schwartz criterion. Based on all the criterion one lag is recommended.

Table 4.1.5: Optimal Lag Selection Criteria Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-477.0923	NA	4.90E+14	50.85183	51.15007	50.9023
1	-284.5251	243.2429*	42367162*	34.37106*	36.45877*	34.72438*

Source: Authors computation (2023)

Note: Indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

The Effect of Sustainable Development Goals on Rural Development

It has been identified that the series of the variables are integrated of order zero and one. So, the study proceeded to the formal testing of long run cointegration by performing the Autoregressive Distribution Lag (ARDL) cointegration test between rural development (RD), manufacturing value added gross (MVAG), health expenditure (LNHE), adjusted net national income (LNADNNI), gross primary education (GPE) and finally for the ARDL model. The F-statistic tested for the joint null hypothesis that the coefficients of the lagged level variables are zero (i.e., no long run relationship exists between them). Two asymptotic critical values bound provide a test for cointegration when the independent variables are I (d) [where $0 \leq d \leq 1$]: a lower value assuming the regressors are purely I (0), an upper value assuming purely I (1) regressors. If the F-statistic was above the upper critical value, the null hypothesis of no long run relationship can be rejected irrespective of the orders of integration for the time series. Conversely, if the test statistic falls below the lower critical values, the null hypothesis cannot be rejected. Finally, if the statistic falls between the lower and upper critical values, the result is inconclusive. Based on the F-Statistics value of the model the F-statistics for this short run and long run model is 227.68 cointegrated at 10%, 5% and 1% significant level from the result it is obvious cointegration exist for the model. The result of the bound test is presented in table 4.1.6:

Table 4.1.6: Bound Test Result

VARIABLES Model (1, 2, 2, 1, 2, 2)	F-STATISTICS	COINTEGRATION STATUS
Critical Values (Pesaran) 227.6774	Lower Bound I(0)	Upper Bound I1)
10%	2.26	3.35
5%	2.62	3.79
1%	3.41	4.68
Note: ***, * denote 1%, 5% and 10% level respectively		

Source: Authors computation (2023)

Estimation of Short-Run Relationship between Sustainable Development Goal and Rural Development in Nigeria

The short run result for model is presented in Table 4.2. It is evident that all the determinants which includes rural development (RD), adjusted net national income (LNADNNI), manufacturing value added gross (MVAG), gross primary education (GPE) and access to electricity (ATELEC) are not all statistically significant but most of the variables are jointly significant based on the joint F-statistics probability value. Moreover, the coefficient of ECT_{t-1} is negative, as expected, and statistically significant. The coefficient of ECM (–1) is found to be statistically significant at the 1% level, with the expected negative sign. This confirms the existence of a long run relationship between the variables. The coefficient of the ECM (–1) term is -0.003, which suggests a relatively a very slow rate of the adjustment process. The magnitude of the coefficient of the ECM (–1) implies that the disequilibrium occurring, due to a shock, is totally corrected in about 1 year and 1 month, at a rate of 0.003% per annum.

The existence of a short-term relationship between rural development (RD) and manufacturing value added gross (MVAG), health expenditure (HE), adjusted net national income (LNADNNI), gross primary education (GPE) and access to electricity (ATELEC) is evident from the outcome of the error correction model (ECM). This shows that there is short-term causality from these variables to rural development (RD).

For the model under consideration the constant term has a positive and significant impact on rural development that is if all other variables in the model are held constant the corresponding value of the impact of constant term on the dependent variable would be 0.71 unit increase. A 1% increase in the constant term will lead to 0.71 unit increase in adjusted net national income has positive and non-significant impact on itself i.e., a 1% increase in LNADNNI (adjusted net national income) would lead to 0.04004 percentage decrease in rural development. This is contrary to economic theory in which increase in income leads to increase output, but this might be possible if increased in income leads to increase in prices leading to increase in inflation. Gross primary education has a positive and significant impact on rural development i.e., a 1% increase in gross primary education would lead to approximately 0.00000022 percentage significant increase in rural development. This is possible especially from the gain realized from multitalented individuals and educated individuals upon the completion of their education is usually big. While one-lag of manufacturing value added gross has a positive and non-significant impact on rural development i.e., a 1% increase in manufacturing value added gross would lead to approximately 0.002 percentage increase in rural development. This is expected as increase manufacturing firstly leads to increase in availability of mechanical devices for farmer to use. The output of the agricultural and rural sector serves as input for the machinery and manufacturing sector. The use of machinery reduces time it would take to process rural products. While increase (1% increase) in health expenditure in the short run leads to 0.02% significant decrease in rural development. This is expected as health expenditure leads to decrease in the per unit income meant for other activities and output, this decrease in

output leads to decrease in further income and decrease in income leads to decrease in expected level of rural development. Finally, a 1% increase in one-lag period access to electricity leads to 0.0002 unit significant increase in rural development in the short run, this is expected as access to electricity enhances manufacturing activities and fast development of rural areas.

Table 4.2: Short-Run Coefficient (Error Correction) Estimate for the ARDL Model

ECM Regression				
Case 3: Unrestricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.712856	0.022899	31.1307	0.001
D(MVAG(-1))	0.000175	5.21E-05	3.365827	0.0781
D(LNHE)	-0.0167	0.002487	-6.712872	0.0215
D(LNHE(-1))	0.011128	0.002467	4.510918	0.0458
D(LNADNNI)	-0.04004	0.002562	-15.62799	0.0041
D(GPE)	2.2E-09	4.07E-10	5.41454	0.0325
D(GPE(-1))	-6.1E-09	3.23E-10	-19.00308	0.0028
D(ATELEC)	-2.7E-05	1.68E-05	-1.62288	0.2461
D(ATELEC(-1))	0.00016	2.46E-05	6.500754	0.0229
CointEq(-1)*	-0.00294	4.25E-05	-69.14641	0.0002
R-squared	0.99923	Durbin-Watson stat		2.857855
Adjusted R-squared	0.998129			
F-statistics	907.8862			
F-p value	0			

Source: Authors computation (2023)

The Durbin Watson value of 2.86 shows the absence of serial correlation and the R-squared value of 0.99% shows that the independent variables explained 99% of the variation in the dependent variable which is rural development.

Long-Run Relationship between Sustainable Development Goal and Rural Development in Nigeria

Table 4.3 reveals that the effect of the independent variables which includes manufacturing value added gross, health expenditure, adjusted net national income, access to electricity, gross primary education considered for long run relationship on the rural development level in the economy. Adjusted net national income has negative and no significant impact on rural development i.e., a 1% increase in LNADNNI would lead to 20.37 percentage decrease in rural development, this is contrary to economic theory, but it might be possible as an

increase in income might lead to increase money supply which might make the rural farmers to stop supplying. Gross primary education has a positive and significant impact on rural development i.e., a 1% increase in gross primary education would lead to approximately 0.0000034 unit increase in rural development, this is possible especially from the gain realized from multitalented individuals and educated individuals after their education will lead to increase rural development through capital flight through these individuals. Manufacturing value added gross has a negative and non-significant impact on rural development i.e., a 1% increase in manufacturing value added gross would lead to approximately 0.11 percentage decrease in rural development, this is contrary to economic theory as increased in manufacturing should increase in rural development. But this can happen if the cost of maintaining the machinery and manufacturing plant is expensive for the rural dwellers or rural areas or it is economical to maintain labor intensive technique of production. Also, from the long run table this result shows that 1-unit increase in health expenditure will lead to 13.4% decrease in rural development this is expected as income available for other spending reduces due to increased health expenditure. Finally, on the long run equation a 1 unit increase in access to electricity leads to 0.05 unit decrease in rural development in the long run. This is contrary to economic theory as access to electricity should lead to increase in rural development. But this can happen if the cost of maintaining access to electricity in the long run is very exorbitant compared to not having access. Then in such instances a unit increase in such instances can lead to 0.05 unit decrease in access to electricity.

Table 4.3: Estimated long -Run Coefficient ARDL Model

Levels Equation		Long-Run		
Case 3: Unrestricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
MVAG	-0.11383	0.222083	-0.512537	0.6593
LNHE	-13.3944	15.55341	-0.861187	0.4799
LNADNNI	-20.3708	11.41003	-1.785338	0.2161
GPE	3.41E-06	3.02E-06	1.132147	0.375
ATELEC	-0.05896	0.054037	-1.091166	0.3891

EC = RD - (-0.1138*MVAG -13.3944*LNHE -20.3708*LNADNNI + 0.000 *GPE - 0.0590*ATELEC)

Source: Authors computation (2023)

Diagnostic Tests

Different diagnostic test values demonstrated at table 4.4 shows that ARDL model identically full fitted for long run as well as short-run result for rural development, manufacturing value added gross and health expenditure, gross primary education, adjusted net national income and access to electricity for the model. The results show that

there is absence of serial correlation and heteroskedascity and all variables are normally distributed with p values above 0.05 for the all the diagnostic test probability value except Harvey heteroskedascity test which has 0.04. The Wald coefficient test confirms that all the variables used for the model are significant with probability value of 0.000. The respective coefficient if each diagnostic is presented in the table below.

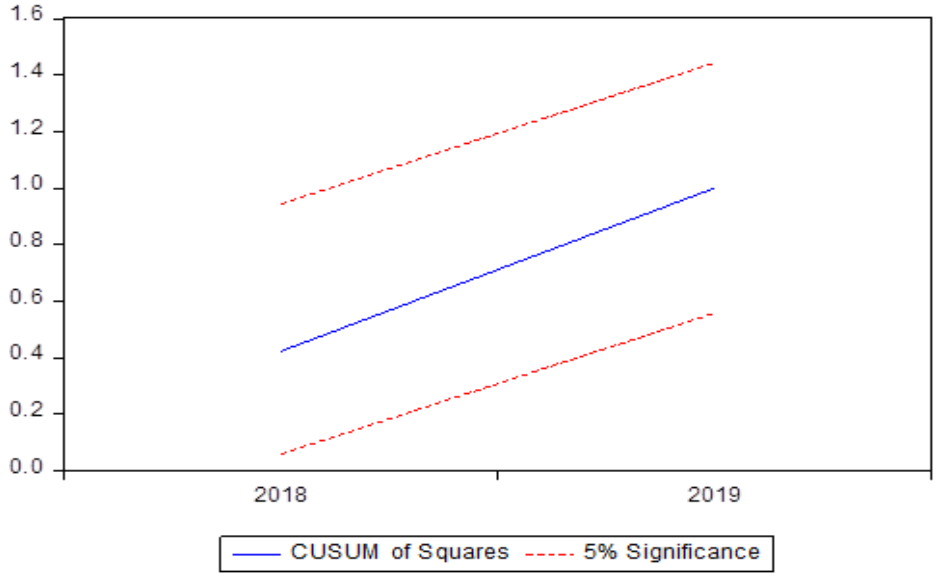
Table 4.4: Diagnostic Test

DIAGNOSTIC TEST	F- STATISTICS	P VALUE
Breusch-Godfrey Serial Correlation test	0.581919	0.5851
Breusch-Pagan Heteroskedascity test	1.333222	0.5108
Harvey Heteroskedascity test	19.98739	0.0486
Wald Coefficient Test		0.0000
Arch	0.400644	0.5363
Ramsey RESET Test (log likelihood ratio)	44.58268	0.0946
Jaque Bera (Normality)		0.9756

Source: Authors computation (2023)

Stability Tests

Finally, the cumulative sum of recursive residuals (CUSUM) and the CUSUM square (CUSUMSQ) tests, proposed by Brown, Durbin, and Evans (1975), are employed to investigate the stability of the model. As seen in figure 4.5. The plot of the CUSUM or CUSUMSQ line do not break the limits which imply that the coefficients are stable. The cusum diagram below followed by cusumsq diagram is presented one after the other.



To achieve the third objective which test for the existence of short run causality between sustainable development goals and rural development. We employed the technique of granger causality. The granger causality test for the existence of short- run relationship between sustainable development and rural development in Nigeria.

Pairwise Granger Causality between Sustainable Development Goal and Rural Development in Nigeria

Table 4.6 presents the results of Granger causality and it comprises three sections null hypothesis, which are F-statistics, and probability value. Making reference to table 4.6 manufacturing value added does not granger cause rural development since the probability value is greater than 0.05. We fail to reject the null hypothesis that manufacturing value added does not granger cause rural development. Also, rural development does not granger cause manufacturing value added since the probability value is greater than 0.05. There is no short run bi-directional causality between manufacturing value added and rural development. The granger causality table also reveals that there is no short run causality between health expenditure and rural development because the associated probability value is greater than 0.05 with a probability value of 0.51. While also rural development does not granger cause health expenditure with associated probability 0.77 probability value. The granger causality table below also shows that adjusted net national income does not granger cause rural development but rural development has granger causality with adjusted net national income because the associated probability value is 0.05. The causality relationship is one way with rural development been the causal factor. Gross primary education has no causality with rural development as associated probability is 0.2247 also, access to electricity has no short run causality with rural development as the associated probability with rural development is 0.98. While rural development has causality with gross primary education and access to electricity by 0.05 and 0.04. This causality table reveals that rural development has causal relationship with the independent variables and not the independent variables having causal relationships with the dependent variable i.e. rural development.

Table 4.6: Showing the Pairwise Granger Causality Test

Pairwise Granger Causality Tests			
Sample: 2000 2021			
Lags: 5			
Null Hypothesis:	**Obs.**	**F-Statistic**	**Prob.**
MVAG does not Granger Cause RD	17	0.57348	0.7209
RD does not Granger Cause MVAG		2.94162	0.1107
LNHE does not Granger Cause RD	15	0.98942	0.5186
RD does not Granger Cause LNHE		0.49271	0.7716

LNADNNI does not Granger Cause RD	16	1.59955	0.3094
RD does not Granger Cause LNADNNI		5.04805	0.05
GPE does not Granger Cause RD	17	1.92183	0.2247
RD does not Granger Cause GPE		4.38039	0.0502
ATELEC does not Granger Cause RD	17	0.13684	0.9773
RD does not Granger Cause ATELEC		4.7557	0.042

Source: Author's computation (2023)

Summary, Conclusion and Recommendations

The study examined the extent to which sustainable development goals affect rural development in Nigeria. It is particularly aimed to empirically examine the trend of poverty measured through adjusted net national income in Nigeria, the effect of sustainable development goals on rural development in Nigeria and the causal relationship between sustainable development goals (SDG) on rural development in Nigeria. The broad objective of this study are to analyze the present state of rural areas, especially in the areas of poverty eradication, and rural infrastructural development i.e. rural electrification, water, transport, health, and education, among others. The variable employed in the study comprises manufacturing valued added gross, gross primary education, annual current health expenditure, and adjusted net national income, access to electricity. Data on manufacturing valued added gross, gross primary education, annual current health expenditure, and adjusted net national income, access to electricity are sourced from world development indicator (WDI, 2021). The study employed various analytic techniques to evaluate the properties of variables identified in the model. These include descriptive statistics of variables, correlation matrix to examine the degree of association between the variables and the unit root test to determine the stationary of the variable. The ARDL bound test procedure was employed to examine the existence of cointegration among the variables. This is necessitated by the mixture of I (0) and I (1) variables in the model. After the existence of cointegration relationship between the variables in the model has been confirmed, the author then proceeded to estimate the cointegration and long run form of ARDL model. With this approach, both the short run dynamics and the long run relationship were analysed and discussed in detail. The study also conducted a diagnostic test which confirms that all variables used for the model are significant; also, the stability test was employed to investigate the stability of the model. Finally, the pairwise Granger causality test is used to test the causality between sustainable development and rural development, the causality test reveals that rural development has a causal relationship with the independent variables.

Based on the findings of the study, the following conclusion was drawn: There exists long-run co-integration between rural development and indicators of sustainable development

goals. The implication is that; access to electricity gross primary education, current health expenditure, and manufacturing value-added gross and adjusted net national income gross remittances as various measures of sustainable development goal can be used as predictive variables of current (short run) and future changes (long run) and rural development. Function is stable for over a period of time based on the CUSUM and CUSUMSQ is stable from 2000 to 2021. Also, the rate of adjustment from the short run to the long run in case of deviation is very slow for the sustainable development and rural development model. Finally, it was also observed that there is short-run causality between indicators of sustainable development goals used in the study and rural development.

Based on the conclusion of this study, the author, therefore, strongly recommends the following for the government and policymakers;

1. Increased income should be matched with increase output not with increased price
2. Exchange rate of naira to dollar should be improved to facilitate increased export and reduced import
3. Government should make basic education up until secondary school free and compulsory.
4. Health expenditure should be reduced, and all health consumable should be affordable frequently.
5. The government should enable long term access to education and to provide health services at a reduced cost.

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