A Conceptual Paper on Population, Economic Growth and Environmental Quality Nexus in Nigeria

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Abstract

This comprehensive study evaluates the evidence and proposes a robust framework for investigating the intricate dynamics of population growth, economic growth, and environmental quality in Nigeria. The study reviews evidence of escalating ecological degradation, including high population density, pollution, urban squalor, deforestation, and carbon dioxide (CO2) emissions. It presents compelling theories that link human population growth, economic growth, and environmental quality. It also explores their profound impact on human well-being and potential relationships with environmental changes. Additionally, the study delves into the empirical literature on Nigerian population growth and ecological change and potential connections to climatic changes. Despite acknowledging the limitations of current knowledge on these relationships, the study emphasizes the need for further research and the potential for future studies to guide policies and practices.

Keywords

Population, environmental quality, economic growth, energy consumption, CO_2 emissions

Introduction

The 21st century begins with a predicted global population of 7.87 billion (UNFPA, 2022; Muttarak & Wilde, 2022). According to the United Nations (UN) forecasts, the world's population will peak at 11 billion in 2200, reaching more than 9.2 billion by 2050. Over 90 per cent of these individuals will live in developing countries (United Nations, 2021; Citaristi, 2021; Canton, 2021). These trends underscore the urgent need for global cooperation, as the rate of global population growth, which peaked in 1963

at 2.2 per cent, has steadily declined to 1.3 per cent in the 2014s before further declining to 1.1 per cent in 2020 (UN, 2021).

Population growth and environmental degradation are global issues that have been steadily increasing, particularly in developing nations (Alam et al., 2007). The resulting deforestation, pollution, and economic expansion are all direct consequences of population growth, posing a significant threat to the environment (Sherbinin et al., 2007). Uncontrolled urban population growth, coupled with climate change, natural disasters, food shortages, and diminishing natural resources, are all contributing to a decline in environmental quality (Dimnwobi et al., 2021). These issues are not just local, but global concerns, and the escalating global population is a universally acknowledged problem. If left unaddressed and unchecked, global population growth could lead to a major catastrophe and pose significant environmental challenges (Ahmed et al., 2017). The environment is rapidly deteriorating due to the strain on ecosystems that support human lifestyles and welfare (ReyesGarca et al., 2019).

Economic growth can have both positive and negative effects on the environment. On one hand, it can lead to increased pollution, deforestation, and depletion of natural resources, harming ecosystems, air and water quality, and biodiversity. On the other hand, economic growth can drive technological advancements and encourage investment in renewable energy and sustainable practices, which can help protect the environment and combat climate change. However, in many developing countries, economic growth has led to environmental issues such as pollution, carbon emissions, and industrial waste due to population growth and human activities. This situation is urgent and requires immediate attention. The environment provides resources to the economy, and the relationship between economic growth and environmental quality influences waste generation and pollution. Natural resources are essential for many industries, but their production and consumption can strain the environment due to pollution and other related problems.

Nigeria, the most populous country in Africa, had a population of 45.2 million in 1960, 88.9 million in 1991, and 140 million in 2006, according to censuses (NPC, 2007) to 213.3 million in 2021 projections (World Bank, 2022). The country's population is currently the seventh largest in the world. It is expanding at an average annual rate of 2.7 per cent, making it the fastest-growing population in the African continent. By 2050, it hopes to surpass the American population as the third-most populous nation on Earth (Colby & Ortman, 2015). This growth is significant when compared to other nations, and if the current rate of progression continues and Nigeria's population continues to grow, the environment will suffer greatly.

Due to the country's increasing population, there is growing concern about the deteriorating environment (Cobbinah et al., 2017; Smil, 2016; Harte, 2007). The

nation's environmental quality is expected to worsen, and per capita emissions will continue to rise as the population expands rapidly (Selden & Song, 1994). This is likely to significantly increase overall environmental degradation, especially in the oil-producing areas in the south-south. Consequently, the country must devise long-term solutions to address environmental degradation. It is important to note that poor environmental quality not only hampers economic growth and well-being by reducing the quantity and quality of resources, but also has severe health implications, among other things.

When we examine the impact of global warming on economic activities, we see that it has become a developmental issue. It threatens the long-term development objectives and the sustainability of many developing countries, including Nigeria. Climate change is projected to result in a significant 6 to 30 per cent decrease in Nigeria's GDP by 2050, or a staggering $100 to $460 billion, if no adaptation measures are taken (Department for International Development, 2009). This highlights the urgent need for proactive planning and adaptation measures. If the current trend persists, the country's GDP could decline by 2 to 11 per cent by 2020. Nigeria's unemployment rate remained at 9.79 per cent in 2021, the same as the previous year (World Bank, 2022).

This study's significance cannot be overstated. Primarily, it should aid in informing decision-makers about the factors contributing to environmental degradation. Following that, it offers guiding principles and recommendations that may aid in addressing environmental issues while preserving long-term expansion and preventing GDP declines in the future.

This study aimed to examine the effects of human population growth, energy consumption, and economic growth on environmental quality in Nigeria. Many investigations conducted in Nigeria appeared to be empirical studies, with only a few conceptual investigations. As a result, this is the literature gap the research expected to fill. According to theories, population growth has a direct link with environmental degradation due to an increase in population escalation rate, which denotes an increase in activities carried out by humans that contribute to environmental degradation as well as economic growth and environmental quality.

This essay has several components: the introduction, research problems or challenges, importance or significance of the study, goals or purpose, and structure of the article are all included in the first section. The second part of the essay provides summaries of comparable and connected theories and actual research. A conceptual foundation is provided in the third section. Conclusions and suggested policies, which are crucial for understanding the implications of the study, are included in the fourth part.

Literature Review

According to a literature review, few studies have specifically looked at how population growth and economic growth affect environmental quality, especially in Nigeria. These studies are both conceptual and empirical; even though there is a sizable body of research on the connection between energy consumption, CO2 emissions, and economic growth, the review of the literature offered here will give a general overview of the pertinent literature before focusing on Nigeria. As a result, there will be two sections to the literature review. The first strand of the literature review is concerned with a comprehensive review of pertinent existing research, while the second is concerned with reviewing pertinent Nigerian studies.

Population growth impacts the environment's quality in developing countries by causing massive deforestation, which serves as a source of energy for most of the rural population (Griffiths & Cropper, 1994). Omofonmwan (2008) investigated Nigeria's environmental challenges and concluded that there was a strong link between population growth and environmental issues such as urbanisation, deforestation, and CO2 emissions. According to Shi (2001), population growth is still one of the leading causes of global environmental degradation. This is especially true in less developed countries, where rapid population growth has dramatically impacted degradation. Abubakar (2014) studied Nigeria's capital city, Abuja city profile, concluding that urban population growth is a breeding ground for environmental degradation.

Ahmed et al. (2015) explored the connection between environmental change and population increase in Pakistan, using deforestation as an indicator of ecological deprivation, and concluded that population growth influences environmental deterioration. Ohlan (2015) concluded that the population is India's primary cause of CO2 emissions. Sulaiman and Abdul-Rahim (2018) found that in Nigeria, economic expansion, population increase, and energy consumption considerably impacted CO2 emissions. Xu et al. (2020) analysed the effects of population growth and agglomeration development on land use intensity using a sample of some Chinese municipalities. The findings highlight the varied impacts that population growth and agglomeration formation have on land use intensity. The strain on land usage intensity rises as the population grows. It concluded that the variables were positively related. Anser et al., 2020 concluded that there is a U-shaped association in SAARC countries between urban population growth and environmental degradation. In Bangladesh, environmental degradation is mainly brought on by population density, urbanisation, and economic growth, according to an analysis of the relationships between

environmental pollution, clean energy, per capita GDP, and trade openness (Rahman & Alam, 2021).

Wang and Wang (2021) discovered that population growth has an impact on environmental degradation in some Chinese regions. According to Wang and Li (2021), population density is increasing per capita CO2 emissions. Wada et al. (2021) concluded that population increase, real GDP per capita, real exports per capita, and real imports per capita all contribute to variations in environmental quality in Brazil. Yaduvanshi et al. (2022) discovered that population exposure was India's primary factor governing climate change risk scores.

The review's second portion focuses on studies examining the connection between environmental quality and economic growth. For example, Grossman and Krueger (1995) concluded that as economies grow, ecological quality deteriorates gradually. Stern et al. (1996) revealed an inverted U-shaped link between environmental degradation and income per capita, indicating that expansion eventually lessens the impact of economic activities on environmental quality. According to Everett et al. (2010), economic growth is a response to the depletion of natural resources and the degradation of flora and fauna. Tiba and Omri (2017) concluded that energy consumption can boost economic growth by boosting productivity and harming the environment by increasing pollutant emissions.

Osobajo et al. (2020) investigated the relationship between economic growth, energy consumption and CO2 emissions. Using the pooled OLS regression and fixed effects methods, Granger causality and panel cointegration tests were employed to examine the correlation between energy consumption, economic growth, and CO2 emissions. Data spanning from 1994 to 2013 from 70 countries were analysed. Energy consumption and economic growth have a substantial positive effect on CO2 emissions. Magazzino et al. (2021) investigated the association between energy use and economic growth in Italy using wavelet analysis on a dataset spanning more than 80 years. The results indicate that while there is a solid short-run correlation, there may not be a long-run relationship between energy usage and economic growth. As a result, only in the near term can the impact of energy use on economic growth be discerned. All frequency bands consistently exhibit this bidirectional causality.

In the opinion of Liang and Yang (2019), environmental pollution considerably hinders urbanisation, and there is an environmental Kuznets inverted U curve between economic growth and urbanization and pollution. Murshed et al. (2021) concluded that economic growth hurts environmental quality. Kihombo et al. (2022) discovered the environmental Kuznets curve (EKC) between ecological footprints and economic growth in the presence of financial globalisation and population density. Therefore, the present research (i.e., Fernandez-Llamazares et al., 2015; Jackson et al., 2013; Liu et al.,

2016; Muhammad et al., 2021; Hamid et al., 2022; Liu et al., 2022; Naseem et al., 2022; Khan et al., 2022; Warsame & Sarkodie, 2022; Shokoohi et al., 2022; Usman et al., 2022) observes some variables concerning population, economic growth, and environmental quality.

Theoretical framework

This section discusses population, economic growth, and environmental theories. Many theories have been proposed in the population-environment literature, and this research focuses on those developed to analyse the population growth process necessary to spur the environment. In analysing the population growth and environmental quality in less developed countries, environmental and development economists began to focus on the economy's structure. Rapid population increase is a common characteristic of the economic structure of developing nations. In other words, LDCs (less developed countries) have historically been and still are dependent on agricultural and mineral resources and a smaller proportion of their resources.

Malthus predicted a near-future catastrophe in which unchecked population expansion would put undue demand on inadequate natural resources (Malthus, 1798). He argued that while population increase is exponential, agricultural productivity grows geometrically, and there is 'endless arable land', a concept that refers to the idea that there is always more land that can be cultivated for agriculture. He predicted that as human populations increased, there would not be enough food to feed everyone, and that 'positive and preventative checks' would reduce the number of people on the planet down below what agricultural systems could support. Positive indicators would be a rise in mortality brought on by epidemics, starvation, higher infant mortality, malnutrition, and conflict. Preventive strategies, such as postponed marriage, contraception, abortion, and infanticide, would reduce fertility and thereby control population growth.

The Malthusian theory is relevant to Nigeria because of the country's rapid population growth and food security challenges. Nigeria has one of the world's fastest population growth rates, which strains scarce resources and infrastructure. However, there are reasons for confidence. Nigeria's fertile terrain and the potential for agricultural growth, coupled with technical developments and economic progress, can reduce the impact of overpopulation on food security. Moreover, international trade can play a significant role in this, providing reassurance about the future.

The Boserupian theory (1965) explores the connections between population, environment, and technology. This theory differs from the 'Malthus' theory, which focuses on population density in a specific area, 'absolute size', and growth rate. Like Malthusian, Boserupian theory also considers the environment and related issues such

as climate changes and soil quality. However, Boserupian theory emphasizes the role of technology in earlier civilizations in developing countries, unlike Malthus, who argued that the tools and inputs used in agricultural productivity were crucial for these civilisations. It is essential to note that neither 'Boserup' nor 'Malthus' precisely addresses the issues of population growth, environment, and technology per se, other than land use or food supply (Marquette, 1997). As the world faces environmental challenges, many environmentalists argue that there is a discernible pattern in population growth trends. Modernization theorists suggest that people progress from unindustrialized to post-industrial stages along an expected continuum.

The idea highlights the need for creativity and human agency in adapting to changing environmental conditions, which is significant to many developing countries dealing with climate change and resource shortages. Boserup's emphasis on the value of small-scale, labour-intensive farming methods is consistent with traditional agricultural practices in many developing countries. The theory emphasises the possibility of sustainable agricultural development through greater productivity and efficiency, which is critical for food security and poverty reduction in developing countries.

The theory has been critiqued for emphasising individual initiative and technical innovation, which may only sometimes be practical in the setting of more significant structural concerns such as land tenure systems, market access, and political instability in poor nations. Boserup's notion of limitless environmental resources and adaptive ability may need to be validated in areas experiencing significant environmental deterioration and natural disasters. The theory fails to effectively address the social and cultural aspects that influence agricultural practices in developing nations, such as gender dynamics, traditional knowledge, and cultural values.

'Ehrlich's theory also held that the impact of the human population on their environment is related to population size, per capita consumption, and the environmental impact of the technology used to produce what is consumed. Despite being oversimplified, this link has been described by the 'IPAT' equation: 'I (impact) ¼ P (population) A (affluence/consumption) T (technology) Paul Ehrlich is a prominent neo-Malthusian. In his study "Population Bomb," he warns us of impending famine due to overpopulation and advocates for population control. He advocated for government intervention in population issues (Ehrlich & Holdren, 1971). Thus, contemporary thinking regards the human population dimension as a multiplicative interrelationship with other factors that impact our environment. As a result, one of the most common multiplier methods is the equation: Environmental impacts = (Population size) + (Level of affluence or per capita consumption) + (Level of technology).

In their study "Analytic tools for unpacking the driving forces of environmental impact," York et al. (2003) proposed using regression to examine the stochastic effects on population, wealth, and technology (STIRPAT). To investigate the effects of socioeconomic changes on environmental degradation, the STIRPAT framework was developed asymptotically. The STIRPAT framework improves on Grossman and Krueger's (1993) traditional EKC (Environmental Kuznets Curve) hypothesis by modelling multiple determinants of environmental degradation.

Ehrlich's theory of population growth and resource depletion may help emerging countries deal with concerns of overpopulation and shortage. However, when applied to developing countries, the theory has some things that could be improved, such as failing to include the importance of socioeconomic conditions, political institutions, and technology in driving population growth and resource allocation.

The hypothesis of the Environmental Kuznets Curve (EKC) emerged in the early 1990s because of the work of Grossman and Krueger (1993), which used Kuznets' (1955) concept as a benchmark. The EKC hypothesis contended that increased economic activity inevitably harms the environment in three stages, notably in size, structural, and composite impacts. After reaching a tipping point, environmental quality increases due to technological advancements and increasing environmental awareness. In the beginning, environmental degradation is evident. According to Kuznets' theory, ecological quality and economic growth are related, with many indicators of ecological degradation tending to worsen as modern economic progress emerges until regular income extends to a particular argument over the economy's progression. Though the issue is still being debated, some evidence suggests that environmental fitness gauges exhibit an inverted U-shaped curve, such as aquatic and air pollution. Consequently, economic growth does not guarantee a reduction in pollution. Pollution is determined by various factors, not only income. Examples include the effectiveness of government control, economic progress, and population levels. Pollution occurs worldwide.

The Material Balance model explains how economic activity and the environment are related. The model depicts the movement of natural resources from the environment to the economy and the economic response in the form of pollution (pollution) back to the environment. The model, which correctly theorized the connection between economic activity and its effects on environmental quality, is an extension of the circular flow theory (Kneese et al., 1970).

Energy intensity theory examines the connection between economic activity and energy use. It aims to comprehend the relationship between overall productivity growth and energy efficiency in various economic sectors. According to the hypothesis,

economies become more energy efficient as they grow, requiring less energy to produce the same amount of production. This is because industrial processes and technology have advanced. However, energy intensity can differ between nations and industries depending on variables like resource availability, regulatory frameworks, and market conditions.

Population growth and environmental theories are highly significant in Nigeria, which faces various issues due to fast population expansion and environmental degradation. These theories are critical for understanding and addressing problems, including urbanisation, deforestation, pollution, and resource depletion. Population growth and environmental theories in Nigeria are notable for their ability to shed light on the relationship between population dynamics and environmental conditions and the possible influence of these interactions on long-term development. By adopting these theories, policymakers and academics can create policies and interventions that support long-term economic growth while protecting the environment. Population growth and environmental theories in Nigeria may have limitations regarding relevance to the country's specific setting, as well as data availability and quality issues. Furthermore, Nigeria's population growth and environmental concerns are complex and linked, necessitating a more holistic approach beyond standard theories.

Methodology

A comprehensive review of available literature on Nigeria's population growth, energy consumption, economic growth, and environmental quality was conducted. Therefore, The approach for this paper involved conducting a library search and evaluating existing literature studies on population expansion, energy consumption, and economic growth. The library search includes online and physical materials, journal articles, and book chapters. The references are based on online resources such as Web of Science, Scopus, Science Direct, and Google Scholar. The desktop literature review provided population, socioeconomic, and ecological parameters indicators, which were discussed for environmental sustainability and population control. Economic growth was also identified as a potential contributor to sustainability. However, the paper also examines the theoretical framework and conceptual foundations of a population, economic growth, and environmental quality. It often includes the research questions and objectives that will guide the investigation. References are exclusively obtained from journal articles, book chapters, or full-text documents. Thus, the limits of this work could be attributed to the previously mentioned limited resources from databases, as the search results are also omitted from Sciences.

Results

The current investigation on the rapid human population rate, economic growth, energy consumption and environmental quality in Nigeria has recommended using a conceptual framework to examine the population-environment, economic growth-environment nexus, and energy consumption-environment in the structure of a box-and-arrow illustration. The framework stated that population growth affects the environment, while economic growth and energy consumption contribute to climate change, which can significantly affect people and their surroundings. This framework's significance and impact on environmental quality will be examined, considering its direct effect on the base of natural resources. The human population growth-induced changes in land-dwelling shelters account for approximately 35 percent of the anthropogenic influence on environmental degradation (Houghton & Hackler, 2001; Awuchi & Awuchi, 2019; Smithberger, 2021). Population growth may force a household to shift away from a moving resource and energy consumption base or result in environmental emissions.

Population growth and environmental quality have a complicated and multidimensional relationship. Population growth can significantly impact the environment, and environmental factors can influence population dynamics. Therefore, there is a rising demand for water, electricity, food, and raw materials as the global population grows. Environmental deterioration may result from the harvest and consumption of these resources, including habitat destruction, depletion of water sources, and deforestation (Hassell et al., 1991; Plaistow et al., 2006). Therefore, this conceptual framework characterizes how the human population affects environmental quality. Thus, population growth associated with a high fertility rate, which may result in demographic pressure due to this issue, may harm the environment (Ellis, 2000; O'Sullivan, 2020). Because of the prominence of this relationship, population growth is commonly recognised as a critical causal influence on land degradation (see Raza et al., 2019; Wang & Dong, 2019; Balsalobre-Lorente et al., 2022).

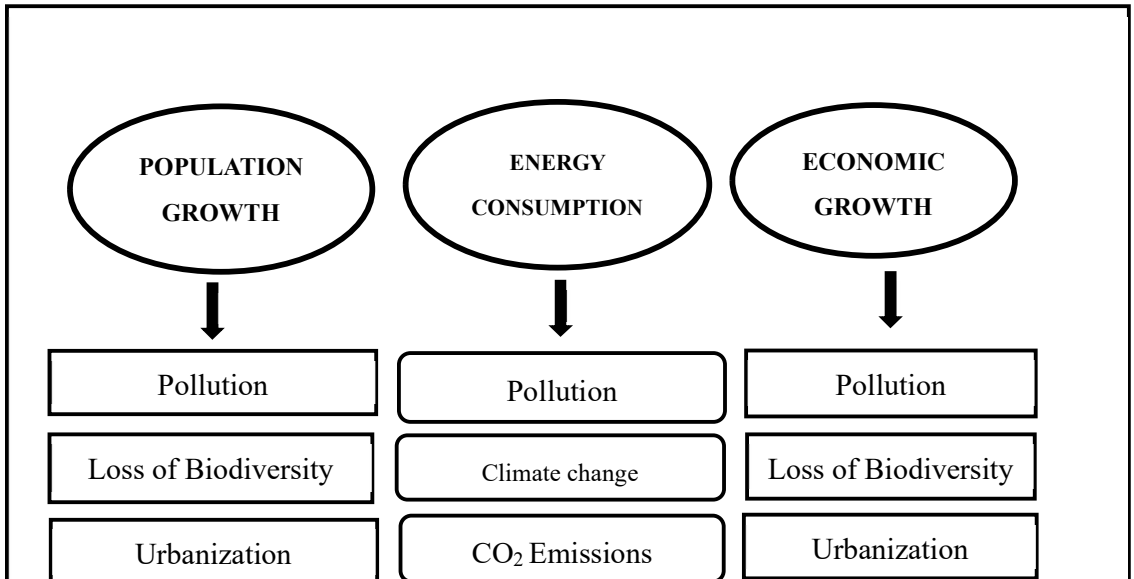

Figure 1 Conceptual framework

Figure 1 Conceptual Framework

Population growth is the primary cause of deforestation, which contributes to environmental degradation (see Kouassi et al., 2021; Saqib & Benhmad, 2021; Olanipekun et al., 2019; Ahmed et al., 2015; Mather & Needle, 2000; Boscolo et al., 1997). However, as they are impacted by population fluctuations and usage patterns of natural resources, rapid population growth and environmental deterioration rarely have a clear proportionate relationship among the variables (O'Sullivan, 2020; Hugo, 2011). Hence, Nigeria's population growth has put enormous pressure on the country's natural resources and environment. As the population proliferates, there is a greater demand for land, water, and energy, resulting in deforestation, water scarcity, and pollution. This has hurt the country's overall environmental quality.

The size of a population and its activities contribute to releasing greenhouse gases and climate change. The effects of climate change can be exacerbated by increased population numbers, which can increase the frequency of extreme weather events, rising sea levels, and other environmental difficulties. Population increase can exacerbate social and environmental inequalities, with vulnerable communities

frequently suffering the brunt of the repercussions of climate change and environmental degradation. Hence, an individual's ecological footprint is the quantity of arable land and freshwater needed to sustain their lifestyle and consumption habits. The ability of the planet to replenish its resources is being tested by the ever-increasing ecological footprint caused by the increasing human population (Moller et al., 2004).

Energy consumption has a substantial environmental impact since the combustion of fossil fuels for energy production emits greenhouse gases and other pollutants into the atmosphere. This leads to climate change, air and water pollution, and other environmental concerns. Subsequently, Greenhouse gas emissions, especially carbon dioxide, are primarily caused by the combustion of fossil fuels (CO2 emissions). Due to these emissions, heat is trapped in the atmosphere, which causes climate change and global warming. One way to lessen these emissions is to switch to renewable energy sources like solar, wind, and hydroelectricity (Omer, 2008; 2009).

Traditional energy sources, such as coal and oil, can emit toxins into the atmosphere and water. One example of a source of pollution that contributes to acid rain and air pollution is coal-fired power stations, which release sulphur dioxide, nitrogen oxides, and particulate matter into the atmosphere. The release of oil and the leaking of pipelines can harm aquatic habitats. These adverse environmental effects can be mitigated by using cleaner alternative energy sources. Thus, there is a risk that habitat loss and land degradation can result from the extraction and use of energy resources. For example, the relocation of native species and other changes to river ecosystems might result from massive hydroelectric projects. Deforestation and habitat damage are also potential outcomes of mining for coal and other minerals. To lessen these effects, sustainable methods and careful planning are required (Dincer,1998; Kaygusuz, 2009).

Non-renewable energy sources are limited resources, such as fossil fuels and some minerals used in energy technologies. The extraction and depletion of these resources can result in environmental deterioration and geopolitical conflicts. Transitioning to renewable and sustainable energy sources reduces our reliance on finite resources. The production and use of energy frequently generate waste from renewable technology, such as spent nuclear fuel, coal ash, and electronic waste. These wastes must be managed and disposed of appropriately to avoid contamination of soil, water, and air (Capellán-Pérez et al., 2014; Arutyunov & Lisichkin, 2017).

Nigeria's energy consumption substantially impacts environmental quality due to numerous elements unique to its energy sector and economic activity. Nigeria relies significantly on fossil fuels, mainly oil and natural gas, to meet its energy demands

(Oyedepo, 2012). The mining, processing, and combustion of these fuels contribute to air pollution by emitting sulphur dioxide (SO2), nitrogen oxides (NOx), particulate matter (PM), and greenhouse gases (GHGs) like carbon dioxide (CO2). This adds to poor air quality in metropolitan areas and can aggravate respiratory and cardiovascular ailments in the population (Heinrich et al., 2020). Thus, Nigeria's energy industry contributes significantly to greenhouse gas emissions, owing to the usage of fossil fuels for electricity production, industrial activities, and transportation (Oyedepo, 2012; Atedhor, 2023). These emissions contribute to global warming and climate change, resulting in altered rainfall patterns, increased frequency of extreme weather events (for example, floods and droughts), and rising sea levels. Climate change threatens agriculture, water resources, and biodiversity in Nigeria.

Economic growth and environmental sustainability have a complicated relationship that frequently entails trade-offs. Economic growth can harm the environment, even though it is typically viewed as a good thing for raising living standards and lowering poverty. However, increased economic growth frequently results in higher natural resource usage. The depletion of resources can affect ecosystems and biodiversity due to the extraction of minerals, fossil fuels, and other raw materials. Thus, Waste can rise with economic growth and increased output and consumption. Environmental damage can result from improper trash disposal (Wang & Azam, 2024).

Like many other emerging countries, Nigeria's economic growth has substantial environmental effects. Thus, economic growth affects the country's environment. In Nigeria, economic growth frequently drives demand for natural resources such as oil, gas, minerals, and forestry. This can result in over-exploitation of natural resources, depletion of reserves, and environmental degradation caused by mining, drilling, and logging operations (Budnuka et al., 2015). Subsequently, economic growth-driven activities such as agriculture, logging, and urbanisation contribute to deforestation and habitat loss in Nigeria. Forests are destroyed for agriculture, infrastructure development, and new settlements, reducing biodiversity and disrupting ecosystems (Rudel, 2013).

As Nigeria's economy grows, industrialisation and urbanisation lead to higher sulphur dioxide, nitrogen oxides, and particulate emissions. Oil spills in the Niger Delta region, untreated industrial effluents, and vehicular emissions all contribute to air and water pollution, which has an impact on human health and environmental integrity (Ephraim-Emmanuel & Ordinioha, 2021). Hence, economic growth increases waste generation, which includes municipal solid waste, industrial garbage, and e-waste. Inadequate waste management infrastructure and procedures contribute to littering, land pollution, and water contamination (Godfrey et al., 2019; Mihai et al., 2021).

Economic growth raises the demand for water in agriculture, industry, and households. In Nigeria, water resources are frequently mismanaged, resulting in over-extraction of groundwater, contamination of rivers and lakes from industrial effluents and untreated sewage, and water scarcity in some regions (Jideonwo, 2014). Nigeria is subject to climate change effects such as rising temperatures, shifts in rainfall patterns, and severe weather events. Economic activities that rely on fossil fuels for energy generation and transportation increase greenhouse gas emissions, worsening climate change effects (Alege & Ogundipe, 2013). Habitat loss, pollution, and over-exploitation of natural resources connected with economic growth contribute to Nigerian biodiversity loss. Species extinction and population decreases reduce ecosystem resilience and their services, such as water purification and climate management (Kolawole & Iyiola, 2023).

Growing economies and industrialisation may lead to more pollution. Pollution of the air, water, and soil can be harmful to ecosystems and human health. For example, emissions from automobiles and factories add to air pollution and climate change. Economic growth can accelerate the expansion of farmland and urban areas, resulting in deforestation. This has profound implications for biodiversity, as many species rely on forests for survival. They are using fossil fuels for energy, while a crucial economic expansion driver, significantly contributing to greenhouse gas emissions and climate change. Climate change endangers ecosystems and human health and causes extreme weather (Ukaogo et al., 2020; Ajibade et al., 2021; Maja & Ayano, 2021).

As Nigeria's population grows, urban regions face more pressure. This promotes rapid urbanisation, which frequently results in unplanned and chaotic development. This can preserve infrastructure facilities and reduce environmental quality by increasing pollution, waste output, and resource depletion (Daramola & Ibem, 2010). Consequently, Nigeria's population growth raises demand for agricultural land, firewood, and timber. This demand frequently causes deforestation and habitat loss, particularly in rainforests and other natural habitats. Deforestation contributes to biodiversity loss, diminishes carbon sinks, and can cause soil erosion and poor water quality in rivers and lakes (Omofonmwan & Osa-Edoh, 2008).

Subsequently, rapid industrialisation and urbanisation, driven by population growth, can produce higher emissions of particulate matter, sulphur dioxide, and nitrogen oxides. Vehicle emissions and industrial activity lead to poor air quality in cities, compromising human health and environmental viability. Furthermore, population growth raises water demand, resulting in the over-extraction of groundwater and pollution of surface water bodies from untreated industrial and domestic wastewater (Iwejingi, 2011; Yahaya et al., 2020).

The environmental degradation drive is still exhausting and tainted, as the

mission aimed at the energy drive remains larger to meet increasing demand in the population (Sornek et al., 2022). As a result, the population continues to grow, as does the demand for more land to provide food and other resources (Fróna et al., 2019). According to the framework, population growth eventually drives the rise in carbon dioxide (CO2) emissions caused by human consumption of fossil fuels (Lin & Agyeman, 2020; Thoredore, 2006).

The persistent increase in population density (human congestion) in urban areas will result in demographic pressure and population density (human congestion), which may also result in more CO2 emissions, which are smoke that is harmful to health and similarly harmful to the environment, such as global warming and air pollution. The population is increasing as a result, which implies severe environmental harm. For example, an increasing population is associated with more vehicles (which produce CO2 emissions), a water shortage in cities, the loss of natural resources, and a rise in rubbish (see Hughes, 1997).

The environmental pressure stress framework considers the interactions between the environment and economic growth (Long, 2022; Kreinin & Aigner, 2022; OECD, 2013). However, economic activities depend on the environment and natural resources such as forests, air, land, and other natural resources that give weight to natural ecological environments (Ahmed et al., 2022). Thus, increased industrial energy consumption and use of fossil fuels will result in increased carbon dioxide (CO2) emissions (Long, 2022).

Household activities also depend on economic growth, which might result in increased CO2 emissions, which are harmful to the environment (Raihan & Tuspekova, 2022; Ge et al., 2022). As a result, any nation must maintain a cordial relationship as well as the current state of the environment and natural resources that will assist in achieving the desires of the current generation while also upholding the desires of the future generation (Pasquale 2020 and Albrecht, 2019). Currently, agricultural productivity covers more than 40 percent of the global surface (Sanderson et al., 2002). The most significant impact of land change on soil is deforestation for tropical agricultural expansion (Geist & Lambin, 2002). Ecological models have confirmed that large-scale forest clearing may impact carbon dioxide emissions and global warming (Nobre et al., 1991).

We assumed that an environment consists of both living and inanimate items that communicate with one another by trading resources and consuming energy (Cropper & Griffiths,1994). There can be no ecosystem if there is no population. To live comfortably and comfortably on this Earth, different plants and animals need various environmental settings and resources. The sum of these conditions and materials is referred to as the environment. All organisms exist within the biosphere, comprised of

air, soil, and water layers. The biosphere contains numerous discrete ecosystems or communities of living creatures interacting with their surroundings. Given that any atmosphere devoid of people is inevitably lifeless (Margalef, 1963; Merchant, 1987; Cropper & Griffiths, 1994; Ehrlich & Ehrlich, 1997).

The population modifies the ecology by depleting resources, modifying them, and building things. Furthermore, with an ecosystem, there can be a population. As a result, a population in a suitable habitat might be considered an ecosystem for ecological research. Ecosystem is the study of living plants, animals, people, and their environments that support life. An ideal environment is one where a species, whether a plant or an animal, may be presumed to have all the circumstances and resources it needs to survive. The idea of an ideal habitat is essential to an ecosystem. The environment has been crucial to Earth's current plant and animal populations (Odum, 1969; Ellis et al., 1988; Watson et al., 2019; MacLaren, 2020).

Cities provide numerous opportunities for their citizens and substantial assistance, including access to social goods and plentiful employment opportunities. At the same time, densely populated areas can create pressures that are trapped between demographic clusters and environmental tension. However, the urban population persists, and the sources of social conflict are still present. Finding a fair approach to distribute municipal resources while lowering pollution and energy consumption, both of which have a detrimental influence on environmental quality, is the key challenge facing today's communities (Ahmed et al., 2004; Suzuki et al., 2010; Sugrue, 2014; Porter, 2015).

Energy consumption is naturally derived from substances or chemicals composed of carbon dioxide and hydrogen. Hydrocarbons are substances formed from carbon dioxide and hydrogen. In oil-rich and oil-exporting countries, the fossil fuel sector is critical to the country's economic and political relationship with the rest of the world. 2019, the oil and gas sector consumed approximately 84 per cent of the world's primary energy (Foit et al., 2017; Martens et al., 2017; Gharizadeh et al., 2020; World Development Indicators, 2020).

Additionally, urbanisation and population density result in both natural and human sources of carbon dioxide (CO2) emissions. Oceanic discharge, respiration, and decomposition are examples of natural sources. The combustion of fossil fuels like coal, oil, and natural gas, as well as other activities like making cement, clearing forests, and logging, among others, create human sources. For this study, we referred to CO2 emissions as dangerous environmental pollutants produced when fossil fuels are burned in manufacturing, construction, and other economic activities. This comprises

CO2 emissions generated by the usage of fossil fuel energy products like gasoline, kerosene, diesel, and other fuels (Letcher, 2021; WDI, 2022).

Policy Recommendations and Conclusion

In sustaining the study's objectives, population growth has been recognised as the primary factor contributing to premature environmental challenges such as carbon dioxide emissions in Nigeria, the study's sample country. Henceforth, the policies interconnected to the control of the rapid population growth rate that will be established in Nigeria, the strategies should be geared towards environmental protection to boost the healthy environment, and this would avert the possibility of population control, whereby the human population interacts with the physical environment without jeopardizing or tempering our environment for future generations. The adverse effects of high population growth include pollution and increased deforestation as a source of energy consumption. In this regard, population control programmes should be supported worldwide to reduce environmental emissions in Nigeria, which frequently encourages individuals to have a fair number of children and to manage our physical environment for future generations' ambitions.

It is dynamic that effort should be directed toward developing and implementing appropriate rules to maintain and protect our physical environment. Rapid population growth adds to various environmental issues, including extensive deforestation as a source of energy used for cooking or something else. Therefore, if the Nigerian government can implement regulations to maintain our physical environment while also controlling human population growth, legislative actions that reduce energy use should be advocated throughout nations. Keeping in mind that much of the human population's growth is due to fossil fuel usage as a means of transportation or for residential generators, the government of Nigeria should adopt high technology as a non-polluting alternative energy source. Eventually, as a signatory to the UNFCCC's Kyoto and Rio de Janeiro conventions, Nigeria needs help determining how to use fossil fuels without increasing carbon emissions. Thus, it is confronted with balancing fossil fuel usage and lowering greenhouse gas emissions.

In examining the impact of economic growth and energy consumption on the environment, the main conclusion of this section was that industrialisation is the primary cause of Nigeria's high GDP, resulting in increased carbon dioxide emissions that are harmful to the environment. This outcome should now serve as an overlay to the means for guiding principal options to reduce the prevalence of carbon dioxide emissions by improving the industrial and production processes, as a factor that is rigorously measured to protect the physical environment in Nigeria, which is on the

path to economic transformation. The following recommendations are offered for Nigeria's environmental and economic growth.

A policy designed to protect our environment by reducing pollution and deforestation during the industrialisation, production, or mining process in Nigeria should expand economic activities, take critical steps to ensure a healthy environment and establish a movement to educate the public on the importance of a healthy ecosystem. The Nigerian government should specify the consequences for pollutants and other emitters who refuse to reduce the allowable abatement to businesses or people. This will also serve as a warning to those who intend to pollute or deforest Nigeria's rainforest.

Henceforth, the course of action proposal that could be understood from the empirical findings is that Nigeria should, as part of its ongoing transformation initiatives, green its energy policies and grow into other various forms of energy with reduced glasshouse smoke emissions. Renewable energy sources, particularly solar and wind, may be considered because Nigeria has abundant solar energy. This will help to minimize CO2 emissions and promote long-run economic growth.

To summarise, Nigeria can improve its environmental quality by implementing policies that manage population growth, promote sustainable energy consumption, stimulate economic growth through environmentally friendly practices, strengthen environmental regulations, and adopt an integrated approach to sustainable development. These ideas attempt to balance economic growth and environmental protection, resulting in a healthier and more sustainable future for the country.

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