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| Research Article

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Climate Change in Nigeria: Strategies and Policy Actions for Effective Mitigation

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Abstract: This study examined various strategies to mitigate against the impact of climate change in Nigeria. By analyzing current research and secondary data on related topic. The paper concluded that climate change is inimical to the socio-economic development of Nigeria if not properly handled and controlled. The paper identified promoting renewable energy sources, implementing sustainable land use practices, and increasing public awareness and education on climate change mitigation are some of the policy measures to adopt to mitigate against the adverse impact of climate change on the Nigeria economy. The paper also suggest that by implementing these measures, Nigeria can effectively decrease its carbon footprint and combat the negative effects of climate change.

Keywords: Climate change, Strategies to mitigate climate change

1.0 Introduction

Nigeria, Africa's most populous country and one of the continent's leading economies, is at the forefront of the climate challenge. According to World Bank projections for a very high emissions scenario, Nigeria is likely to experience a significant rise in temperatures, reaching between 2.9°C and 5.7°C by 2100. The country ranks 154th out of 181 in the ND-GAIN 2021 index, which assesses vulnerability and resilience to climate change. Its dependence on agriculture makes it particularly sensitive to climate disruptions. According to the World Bank, around 78% of Nigeria's land area is devoted to agriculture, the majority of which is rain-fed (with less than 1% irrigated) and carried out by small-scale farmers using traditional methods. In addition, its varied geography exposes it to many extreme weather phenomena. In the north, rising temperatures and desertification could exacerbate existing problems related to water supply and food security, which are already major challenges inthis region. For example, rising CO_2 levels in the atmosphere are expected to lead to a 17% drop in nutrients in rice, while fluctuations in temperature and rainfall will likely reduce rice yields.

In the south, coastal areas and river basins are exposed to flooding, resulting in loss of life and damage to infrastructure. In 2022, according to the Nigerian Hydrological Services Agency (NIHSA), the worst floods on record destroyed more than 440,000 hectares of farmland, affecting

more than 1.4 million people, causing more than 662 deaths and displacing thousands of residents. Direct economic damage is estimated at a median value of USD 6.68 billion. Rising sea levels are also threatening the Nigerian coast, particularly Lagos, with erosion, salinisation of land and flooding. According to an article by the Boston Consulting Group, Lagos could be flooded by extreme weather events under 1.5 metres of water, and up to 2.5 metres by 2050 (Safeguarding Coastal Cities from Climate Change, 2023)

Climate change is accelerating the degradation of ecosystems in Nigeria, reducing the country's resilience to climatic shocks. Deforestation, driven by agricultural expansion, illegal logging and charcoal production, is leading to a loss of biodiversity, soil erosion and a reduction in the capacity of forests to absorb carbon. According to the Global Forest Watch (GFW) initiative, between 2001 and 2023, Nigeria lost 1.33 Mha of tree cover, equivalent to a 13% decrease in tree cover since 2000 and 724 Mt of CO_2 emissions.

The agricultural sector, which accounts for around 25.18% of GDP and covers 70.8 million hectares of farmland, is severely affected by drought, flooding and soil degradation, leading to lower yields of staple crops such as maize, cassava, millet and rice. By 2070, rising temperatures are expected to reduce rice yields in Africa by an average of 24%, especially in rain-fed rice-growing areas, according to the United States Agency for International Development (USAID).

This situation is already forcing the country to import on a massive scale. According to the World Bank, food imports are projected to account for 11% of Nigeria's total imports in 2023. In the first quarter of 2024, Nigeria spent USD 689.88 million on food imports, representing 17% of total foreign currency expenditure on imports and a 40% increase on the previous quarter. By 2100, with population growth set to more than double, agricultural losses could account for between 2% and 4% of GDP in West Africa, according to USAID (**Peter, 2024)**.

The electricity sector will also be heavily affected. Flooding threatens onshore oil and gas production, impacting export revenues. It will also affect electricity generation, 73.5% of which will come from natural gas by 2023, according to the International Energy Agency (IEA). The total value of damage to the sector from the 2012 floods, among the worst on record, is estimated at NGN 329m (EUR 187k), with the value of lost revenue estimated at a further NGN 8,013.6m (EUR 4.5m), bringing the total effect on the sector to NGN 8,342.6m (EUR 4.7m). Additionally, the drought is diminishing river flows, which in turn is reducing output from hydroelectric power stations. Despite its smaller share compared to gas, hydroelectric power remains crucial to the country's electricity supply, accounting for around 20.4% of total production in 2023, according to the IEA. Finally, heat waves increase energy demand, particularly for air conditioning, and strain the already fragile electricity grid. According to the World Bank, electricity shortages are currently estimated to cost businesses USD 29 billion a year, or more than 5% of GDP (IPCC (2018).Ogbuabor & Egwuchukwu, 2017;Peter, 2024).

The impact of climate change on the on every aspect of the Nigerian economy is obvious and impactful. There is need to mitigate the impact of the climate change. This paper presentation will explore the various strategies that can be used to mitigate against the impact of climate change in Nigeria.

1.2 Theoretical Framework:

This study employed social role theory. Role theory was propounded by Ralf Dahrendorf, Robert K Merton and Gorge Herbert Mead in 1956. Role theory proposes that human behaviour is guided by expectations held by both the individual and other people (Osadebe, 2014). A social role refers to the behaviours and responsibilities expected of individuals in society. In terms of gender, social roles prescribe certain behaviours to men and women. These roles are known as gender roles. Women's gender roles, or social roles for women, include mother, caretaker, and helper. Men's gender roles or social roles for men include breadwinner, protector, and leader. Role theory is the

theory that an individual's behaviour is the performance of roles that are organized into categories defined by society. Individuals aim to meet these roles, which encompass certain expectations, responsibilities, and behaviours. People perform gender roles daily, meaning that their behaviours are shaped by societal expectations for them depending on their gender (S. M., 2022). The implication of this theory to this paper is that every stakeholder (Government, communities, private institutions and international organizations) in the climate change management have critical and specific role to play in the effective management of the climate change in Nigeria.

2.0 Literature Review

2.1 Concept of Climate Change

Climate change reflects the variations in the average daily weather conditions such as temperature, humidity, rainfall and sunshine of a location over an extended period. Climate change in Nigeria threatens economic growth in sectors dependent on climatic conditions (Adams, Zubair, & Olatunde-Aiyedun, 2022). Climate Change" refers to big, long-lasting changes in how the weather works all around the world. Global warming is a big part of this—it's like the Earth's atmosphere getting warmer because it's holding onto more heat from the sun. Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas. Climate change refers to long-term alterations in temperature, precipitation, wind patterns, and other aspects of the Earth's climate system. These changes can occur over decades, centuries, or even millions of years and can be driven by both natural processes and human activities (Muhammad, 2022; Amarachi, Ihuoma,, Ojiugo & Osmond, 2025). Unlike global warming, which specifically denotes the rise in Earth's average surface temperature, climate change encompasses a broader range of changes, including extreme weather events, sea-level rise, and shifts in ecosystems (Aiyedun, 2020; Muhammad, 2019 Bogdanovic, Nikolayeva, Novikov, Siljic, Simonett,, Egerer,& Sandei, P.C.2012).

2.2 Common Causes of Climate Change in Nigeria

Although natural hazards like volcanic eruptions contribute to climate change, scientists have now discovered that certain human activities are also responsible. Environmental scientists associate climate change effects with the depletion of the ozone layer in the atmosphere. The ozone layer prevents the heat from the sun from reaching the earth at high intensity. The ozone layer is depleted when certain gases are released into the atmosphere from human and natural factors. These gases are: carbon monoxide, Sulphur dioxide, chlorofluorocarbon, and similar when these greenhouse gases contribute to global warming, where the heat from the sun is trapped on the earth's surface. This gradually leads to excess heat depending on depletion level and quantity of the gases emitted over time. Human activities that cause climate change are:

1. **Emission of greenhouse gases from vehicles**: Some vehicles emit greenhouse gases such as sulphur dioxide and carbon monoxide from their exhaust.
2. **Burning of hydrocarbon products:** This releases carbon dioxide and other gases into the atmosphere.
3. **Deforestation:** This refers to cutting down trees, usually for agriculture. Trees form a protective barrier against the heat from the sun and cutting them down affects this purpose.

Industrial emissions: Industrial activities and equipment produce greenhouse gases that are emitted into the atmosphere instead. Muhammad (2021), Mbah (2024) and Olatunde-Aiyedun, Micheal Olatunde, and Ogunode (2025) noted that burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures. The main greenhouse gases that are causing climate change include carbon dioxide and

methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and cutting down forests can also release carbon dioxide. Agriculture, oil and gas operations are major sources of methane emissions. Energy, industry, transport, buildings, agriculture and land use are among the main sectors causing greenhouse gases (UN).

3.0 Method

It is a systematic literature review-based report. It has collected and reviewed the related previous literature from various online sources. It has collected secondary information to generate knowledge on this topic from 2015-2025. It has followed the qualitative narrative design. The researcher has visited different online sites to collect the previous literature and analyze the strategies to mitigate the impact of climate change in Nigeria. The previous findings are critically analyzed and presented in different themes as the strategies to mitigate the impact of climate change in Nigeria is reported by previous findings.

Inclusion and exclusion criteria

This research article presents the results of an in-depth study that included conference and article. It excludes information from edited books, preprints, monographs, information below 2015 and book chapters.

4.0 Result on Strategies to mitigate the impact of Climate Change in Nigeria

There are many strategies to mitigate the impact of climate change, Chime (2021) noted that such strategies include forestry practices, regenerative agriculture, restoration of coastal wetlands and marine ecosystems.

1. For forestry practices, there is reforestation and afforestation where forests are either planted, replanted, or allowed to regrow naturally. They also have to do with improving forest management, protecting forests, and limiting deforestation. Forests help in addressing climate change by serving as carbon removal or sinks. They naturally absorb carbon from the atmosphere and isolate it inside trees (sequestration). This means that carbon sequestered in these trees does not get emitted into the atmosphere, thereby limiting the impact such carbon would have had in worsening global warming and climate change.
2. There is also regenerative agriculture whereby lands are managed in a way that soils absorb and hold more carbon. It involves practices that build soil carbon, such as cover crop rotation, farming without tilling the ground (no-till farming), agroforestry (mixing tree planting and agricultural land use), and improved livestock management. Regenerative agriculture contributes to the reversal of global warming by increasing the capacity of the soil to capture carbon.
3. Restoration of coastal wetlands like mangroves is a natural climate solution that allows carbon to be stored in sediments and plants. Restoring and conserving such places as peatlands and coastal wetlands serves mainly to prevent greenhouse gas emissions.
4. The ocean also has a role to play in offering ocean-based solutions. The practice of restoring and expanding marine ecosystems can help to tackle climate change. This can be achieved through practices that seek to restore seagrass meadows which can trap carbon around their roots, leaves, stems, and underwater sediments. Also, shellfish farming can also be adopted because **research** shows that the shell of shellfish absorbs carbon as it grows.

Also, Bryioku, (2024).believed that if Nigerian government adopt encourage the following strategies to mitigate the impact of climate change in Nigeria.

A). Embrace Climate-Smart Agriculture:

Nigeria is a developing economy with a 2022 statistics of an estimated population of 88.4 million people who live in extreme poverty. Agriculture can be a solution to the poverty experienced by a majority in Nigeria. According to the World Bank, investing in the agricultural sector is more effective at raising incomes among the world's poorest. Still, traditional farming methods in Nigeria are often vulnerable to droughts and floods. Climate-smart agriculture (CSA) offers a solution. CSA is a set of farming methods that is aimed at increasing the resilience and productivity of the land affected by climate change. Practices like using drought-resistant crop varieties, practicing water-saving irrigation techniques like drip irrigation, and incorporating cover crops to improve soil health all contribute to a more resilient agricultural system. By adopting CSA techniques, Nigerian farmers can not only protect their livelihoods but also become part of the climate solution. It is important to note that Climate Smart Agriculture is a solution to the many problems caused by climate shocks but not a final solution to climate change.

B). Plant Trees, Reap the Rewards:

The United Nations places Nigeria as the highest with a deforestation rate in the world, with an estimated 3.7% of its forest lost every year. Expanding agriculture and logging; both illegal and legal are some of the causes of deforestation in Nigeria. Still, it is imperative to understand that forests play a vital role in regulating climate.

Interestingly, in 2023, some of the States in Nigeria were involved in tree-planting initiatives. There is still a lot that needs to be done. Nigeria could take a cue from Ethiopia that accomplished an exceptional feat in 2019 when they planted 350 million trees within 12 hours. Large-scale tree planting initiatives can create green corridors, improve air quality, and mitigate the effects of floods and droughts. Planting trees also provides economic benefits. Programs that encourage community involvement in tree planting, with benefits like carbon credits or fruit production, can create a sense of ownership and ensure the long-term success of these initiatives.

C). Harness the Power of Nature:

Harnessing solar energy technologies for generating electricity as an option for fossil fuel energy usage in Nigeria could prove to be a huge solution to climate change problems. The solar radiation potential in the northern and southern regions in Nigeria is given as 5.62 up to 7.01 and 3.54 up to 5.43 kWhm-2 respectively. Nigeria boasts abundant sunshine and investing in solar energy solutions like rooftop panels or community solar farms can significantly reduce dependence on fossil fuels. Solar power is not just environmentally friendly; it's also reliable and cost-effective in the long run. Government incentives and microloans can make solar technology more accessible, empowering individual households and businesses to become energy independent. Practical solutions are needed to accelerate the adoption of renewable energy. A notable example is the "Nigeria Police Green Initiative" that was announced last year.

D). Waste Not, Want Not:

The challenge of having sanitary landfills in Nigeria is still a huge conversation when it comes to creating solutions for climate change problems. Most States in Nigeria still operate open dumping. Organic waste, when left to decompose in landfills, releases methane, a potent greenhouse gas. Composting kitchen scraps and yard waste transforms this waste into nutrient-rich fertilizer, perfect for boosting soil health in gardens and farms. This simple practice reduces reliance on chemical fertilizers, promotes a circular economy, and mitigates climate change. Landfills can also be areas that can be transformed into thriving green spaces that would be fit for the whole surrounding community to enjoy. Some examples are the Mucking Marshes Landfill in England that was transformed to Thurrock Thameside Nature Park, Mount Trashmore Park in Virginia, USA, Qiaoyuan Park in China and Chambers Gully in Australia.

E). Embrace Sustainable Water Management:

Nigeria faces growing water scarcity. Inadequate access to water contributes to the water and sanitation crisis in Nigeria. According to the World Bank, approximately 70 million Nigerians do not have access to safe drinking water and 144 million do not have access to basic sanitation facilities. One solution to the water crisis that affects climate change in Nigeria is to adopt sustainable water management. Rainwater harvesting systems can capture and store precious rainwater for later use. This captured water can be used for irrigation, washing, or even drinking after proper treatment. Promoting water-saving practices like fixing leaky faucets and taking shorter showers can further reduce pressure on freshwater resources.

In the tertiary institutions environment, Climate action according to Olatunde-Aiyedun, et al (2025) should support the following recommendations:

a) Universities should offer Environmental Education programs, as well as inculcate environmental education as a general studies (GST) to promote the right attitude towards sustainable use of environmental resources and acquire environmental literacy on climate adaptation and mitigation measures. Governments should take the necessary steps to make it a part of the curriculum.

b) School teachers should be provided with the necessary advanced level of educational and handson training from scientists from local research bodies on climate change

c) Governments have a critical role in combating global warming from the legislative and policy perspective, but to ensure the targets set for 2050 have a realistic chance of being achieved, we need change at a societal level. The IS and technology industry has a critical role to play in the monitoring of progress toward net zero, but also a pivotal role in the development of innovative solutions to better manage emissions and offer people alternatives to current carbon-based practices.

d) Climate change should not only be a course in general students where it will be compulsory for all students to offer and pass before graduating successfully from a university, but students should inculcate the right attitude of becoming ambassadors for sustainable living by responsibly making use of technologies in a way that helps reduce carbon emissions.

e) Higher education institutions can provide knowledge and resources to learners and create awareness, inspiring the next generation to navigate the complexities of climate change.

f) Education and training can encourage learners to think about technological and behavioral changes to reduce and mitigate environmental impact within their local sphere of influence and macro level.

g) Stakeholders to accelerate carbon-neutral business practices and build environmental resiliency. Several universities are forming coalitions committed to climate action, such as the University Climate Change Coalition, to leverage scientific knowledge and expertise for climate change solutions.

4.1 **Conclusion and Recommendations**

In conclusion, climate change is a development issue that should be mainstreamed into various sectors of national, regional and state development plans. That climate change has disastrous consequences which Nigeria has began to experience especially in the southern Nigeria as reflected in the massive flood experienced in 2012. Indeed, television reports only recently showed vast areas of Niger and Kano states experiencing massive flood tending towards the type experienced in 2012.

Some of the solution proffered were the need to mainstream climate change into national, regional and state development plans, adapt policies needed to be an integral part of government

initiatives, given the cross-cutting nature of the impact of climate change, as well as provide an important intersection between development and climate change adaptation and remediation in that they both aim to reduce the root causes of vulnerability. Others include raising awareness on issues of climate change which is presently at low ebb especially amongst vulnerable groups like women, children, even at the grassroots, especially rural dwellers, as well as revive the tree planting program by raising awareness for individuals to plant trees. “

As part of the efforts to mainstream the climate change,, the Federal government has proactively taken steps in addressing environmental problems. These include effective management of waste, flood and coastal erosion. It has also built up our advocacy programmes through workshops, seminars, public lectures, media campaign, climate change and waste water summits, tree planting land reclamation, landscaping and beautification, campaign against desertification through the desert warriors, and control of land, water, noise and air pollution.

Allied to this, the Great Green Wall of the Sahara and the Sahel Initiative is a planned project to plant a wall of trees across Africa at the southern edge of the Sahara desert as a means to prevent desertification . It is to be implemented in Nigeria in eleven frontline States of Adamawa, Bauchi, Gombe, Kebbi, Sokoto, Zamfara, Katsina, Kano, Jigawa, Yobe and Borno. It will cover 43 LGAs in the frontline states to be covered to rehabilitate 225,000 Ha of lands. It involves establishment of green wall or shelterbelt from Kebbi State to Borno State, a distance of 1,500 km and 15 km wide, Community Sensitization & Mobilization, Promotion of alternative sources of energy, promotion of alternative means of livelihoods, Promotion of dry land agricultural technology and promoting alternative water source for human, plant and animal use through solar powered boreholes, with over 300 functional boreholes in operation as at early September 2016.

Apart from the suggestions encapsulated in the communiqué, and steps taken by government so far, there is also the need to adopt appropriate technologies to mitigate the scourge at all levels, while there should be strengthening of the weak human capacity and infrastructure for mainstreaming climate change in national development. Similarly, as part of the science of climate change the curriculum planners should ensure that they put in place core knowledge of, and information about, climate change as part of compulsory education for students at all levels. Students should learn about the potential impacts of unmanaged climate change, as well as options for adaptation and mitigation, in order to enable a complete and robust understanding. Additionally, University lecturers should be financially motivated to carry out research in various fields of knowledge related to climate change, so that innovative research can contribute to practical solutions. Furthermore, policy makers, school administrators, teachers, parents, and students should embark on raising awareness of climate change in Nigeria.

Also, appropriate technologies for adaptation and mitigation should be deployed at all levels, while there should be strengthening of the weak human capacity and infrastructure for mainstreaming climate change in national development. Furthermore, it is presently being argued that there is paucity of data for mainstreaming of climate change in development issues, and there is an urgent need to reverse this trend by generating abundant data and statistics that will enhance the application of key performance indicators for the purpose of effective monitoring and evaluation.

One is very positive and hopeful that with adherence to the solutions proffered during the two-day south-south regional intensive training workshop contained in the communiqué issued after the overall plenary that were discussed elsewhere in this feature, coupled with my personal suggestions in this story will go a long way in taming climate change disasters thereby enabling both government and the people to concentrate on programmes, policies, projects and activities that will eventually enhance the determination of President Tinubu’s Administration to move the nation forward thereby achieving the desired change.

In my final submission, climate change is one of the biggest challenges in the world. Fossil fuels – coal, oil, and gas emission into the atmosphere are by far the largest contributor to global climate change, accounting for over 75 percent of global greenhouse gas emissions and nearly 90 percent of all carbon dioxide emissions. As greenhouse gas emissions blanket the Earth, they trap the sun's heat. This leads to global warming and climate change. Climate change is already impacting health in a myriad of ways, including the loss of lives, and illnesses from increasingly frequent extreme weather events, such as heatwaves, storms, and floods, the disruption of food systems, increases in zoonoses and food-, water- and vector-borne diseases, and mental health issues. The more we reduce emissions right now, the easier it will be to adapt to the changes we can no longer avoid. Mitigation actions through Environmental Education would help to sensitize individuals on early warning signs of climate crisis.

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