"ADAPTING TO A CHANGING WORLD: STRATEGIES FOR MITIGATING THE GLOBAL CONSEQUENCES OF CLIMATE CHANGE"

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ABSTRACT
This research focuses on global climate change and adaptation strategies. Climate change globally has become one of the shocking certainties of the 21st era and it has made scientists to raise the need to drop worldwide temperatures further by 0.5 °C which makes a substantial difference in some areas of the world, particularly developing countries that are faced with the greater threat of climate change. Developing States have become exposed to the damaging effects of climate change because of their varied climatic regions and these have affected their food production activities due to the deforestation problem, desertification, soil degradation, erosion, flooding, general habitat loss, depletion of natural resources etc. This study therefore attempts to examine the extent to which continuous climate change has affected the globe and how institutional frameworks have addressed the current situation in ensuring effective control across the globe. The research employed purely on secondary means to gathered data. This research structures its opinions with the human security model as its theoretical framework. Major findings showed that environmental degradation, desertification caused by climate change had greatly stunted agricultural production and government rules universally; climate change has increased food uncertainty, poor statistical analysis and implementation by government. The paper recommends that government should provide alternative means like renewable energy, reduction of industrial carbons in tackling the menace of climate change globally, there should be reduction of emission of greenhouse gases by stopping deforestation, the use of high yield and disease tolerant crops, and also crops adaptable to high level of weather conditions, there should be easy accessible information on climate change effects to the public.

Introduction

Climate change is one of the most serious environmental and human threats undermining the achievement of the Millennium Development Goals (MDGs) and the international efforts to reduce extreme poverty. This is endemic because budgetary allocation of nation's meant for other aspects of the economy are now being channeled towards avoiding or mitigating the effects arising from climate change. Climate change and environmental sustainability has emerged as a major challenge to development in the 21st century. Speranza (2010) posited that recent research has noted the impacts of climate change on agriculture and natural resources management in theCountries of Asia, Africa, and Latin America. As a result of low adaptive capacities and the projected impacts of climate change; a consensus has emerged that developing countries are more vulnerable to climate change than developed countries, because of the predominance of rain-fed agriculture in their economies, the scarcity of capital for adaptation, measures their warmer baseline climate and their heightened exposure to extreme events (Fischer 2005; Nnamdi and Ozor 2009 in Okolie, Ossai and Eze, 2013: 48).

Climate change has become a factor that has harped on and compounded the problems of the globe through an environmental dimension. Moreover, it has been viewed by philosophers in the past passively as less harmful, but due to the current globalization of values, information and trends aided by science and technology, free movement of goods, services and information likening the world as a global village; certain problems and social changes as climate change has been viewed to be of local contributions in different atomized but yet connected and global effects. Climate change has had itself to be presented as having a catastrophic end in parlance of the sustenance of the world's biological and non-biological existence.(www.wikipedia.com as cited in Edeh and Leo-Nnoli, 2014: 18).

According to Food and Agricultural Organisation (2008), climate change phenomenon seriously affect agriculture also in a number of ways. For example, uncertainties in the onset of the farming season, due to changes in rainfall characteristics (early rains may not be sustained, and crops planted at their instance may become smothered by heat waves) can lead to an unusual sequence of crop planting and replanting which may result in food shortages due to harvest failure. Extreme weather events such as heavy winds, and floods, devastate farmlands and can lead to crop failure. Availability of agricultural products is affected by climate change directly through its impacts on crop yields, crop pests and diseases, and soil fertility. Already climate change is creating increased uncertainty about future temperature and precipitation regimes which makes investments in agriculture and other weather-dependent livelihoods inherent riskier and has increased the burden on food security and income among many farmers in the region.

The Intergovernmental Panel on Climate Change (2001) states that climate change is a change to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Although the length of time it takes the changes to manifest matters, the level of deviation from the normal and its impacts on the ecology are most paramount. This prompted Ayoade (2003), to states that secular variations in climate occurring over a period of 100 to 150 years may not qualify as a climate change if conditions will quickly reverse later, but a change in climate usually takes place over a long period of time of at least 150 years with clear and permanent impacts on the ecosystem. Climate change is different from the generally known terms like climatic fluctuations or climatic variability. These terms denote inherent dynamic nature of climate on various temporal scales. Such temporal scale variations could be monthly, seasonal, annual, decadal, periodic, quasi-periodic or non-periodic. Climate change is caused by two basic factors which include natural processes (bio geographical) and human activities (anthropogenic). The natural processes are the astronomical and the extra-terrestrial factors the astronomical factors include the changes in the eccentricity of the earth's orbit, changes in the obliquity of the plane of ecliptic and changes in orbital processes while the extra-terrestrial factors are solar radiation quantity and quality among others. On the other hand, the anthropogenic factor in climate change involves human activities that either emit large amount of greenhouse gases into the atmosphere that depletes the ozone layer or activities that reduce the number of carbons absorbed from the atmosphere to the human factors that emit large amounts of greenhouse gases include industrialization, burning of fossil fuel gas flaring, urbanization and agriculture. Be that as it may, human activities that reduce the

amount of carbon sinks are deforestation, alterations in land use, water pollution and agricultural practices. The human factors have been proven to be responsible for the on-going unequivocal climate change or global warming (IPCC 2007). The emitted greenhouse gases are carbon dioxide (CO chlorofluorocarbons (CFCs), Methane (CH4) and nitrous oxide (N2O) amongst others. In other words, Climate Change or Global Warming is caused by emission of heat trapping gases produced by vehicles, power plants, industrial processes and deforestation. The issue of climate change has become more threatening not only to the sustainable development of socio-economic and agricultural activities of any nation but to the totality of human existence (Adejuwon 2004) as cited in Tersoo and Ogochukwu, 2014,p. 36).

Science for a Healthy Planet and Safer World (2019) asserted that global heating is now taking important and high possessions on our societies, our wellbeing, and our temperature. Except we consider to take instant action to decrease global heating releases, these effects will linger to increase, raise continuously and more high and destructive, and gradually touch the whole globe, including everyone, town, and people immediate family.People are seriously facing a possibly confounding increase of hazardous hotness over the coming years, with fast and prevalent rises in extreme hotness expected to happen across the United States as a result of climate change. Average global sea level has enlarged eight edges then 1880, however is increasing greatly faster on the United States, East Coast and then Gulf of Mexico. Worldwide heating is now hastening the amount of sea level increase, growing flooding dangers to population sand high-risk seaside properties whose expansion has been heartened by today's flood coverage structure.

Conceptual Review

Climate Change

Intergovernmental Panel on Climate Change (IPCC, 2007) defines climate change as a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and /or the variability of its properties, and that persists for an extended period typically decades or longer Although the length of time it takes the changes to manifest matters, the level of deviation from the normal and its impacts on the ecology are most paramount.

The United Nation Framework Convention on Climate Change, (UNFCCC, 2005) conceptualized climate change as 'A change of climate, which is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere, and in addition to natural climate variability, observed over comparable period of time. The most general concept of climate change therefore, is a 'change in the statistical properties of the climate system when considered over a long period of time, regardless of the cause'. Accordingly, fluctuations over periods shorter than a few decades do not represent climate change. The term is, sometimes, used to refer specifically to climate change caused by human activity, as opposed to changes in climate that may have resulted as part of the earth's natural processes. In this respect, especially in the context of environmental policy, the term climate change has become synonymous with anthropogenic global warming. However, scientifically, global warming refers to surface temperature increases while climate change includes global warming and everything else that increasing greenhouse gas levels will affect. Thus, simply put, Climate change is a long-term change in the statistical distribution of weather patterns over periods of time that range from decades to millions of years. It may be a change in the average weather conditions or a change in the distribution of weather events with respect to an average, for example, greater or fewer extreme weather events. Climate change may be limited to a specific region, or may occur across the globe.

Gregory, Ingram and Brklacich (2005) reported that dynamic interactions between and within the bio-geophysical and human environments lead to the production, processing preparation and consumption of food, resulting in food systems that underpin food security. Thus, there is a palpable misapprehension and trepidation that climate change will affect all four dimensions of food security: food availability, food accessibility, food utilization and food systems stability. It is envisaged that change in climate will have an impact on human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows.

Causes and Effects of Climate Change

Uzoechi (2009) affirmed that as the concentration of greenhouse gases increases, the temperature on earth will also increase.

Other causes of changes in the average temperature of the earth include ocean currents which move vast amounts of heat across the planet and volcanoes which introduce sulphur dioxide, water vapour, ash and dust into the atmosphere. Increasing temperatures tend to increase evaporation which leads to more precipitation. As average global temperatures have risen, average global precipitation has also increased. As a result, there has been an increase in the number of heavy precipitation events over many years during the past century as well as an increase since the 1970s in the prevalence of droughts especially in the tropics and sub-tropics (Okebukola & Akpan, 2009). Increase in the earth 's temperature might lead to the melting of the ice caps resulting to a release of more water into the oceans so that sea levels will rise and consequently many low-lying areas of the land will be flooded. Thus, the melting of glaciers and ice sheets in some areas swells the seas and as the sea in invades the mouths of rivers, flooding from runoff will also increase upstream as cited in Nzewi, 2009; Uzoechi, 2009).

There is a global consensus about the causes of climate change. It is generally agreed that climate change is instigated by human activities. A chief contributor is the global over-dependence on the use of fossil fuels to meet energy needs. The use of fossils leads to the release of greenhouse gases (GHGs), mainly carbon dioxide (CO_2) and methane into the earth's atmosphere. Fossil fuels are mainly produced from natural gas. They all release CO_2 at production and consumption points. Fossil fuels constitute the primary source of energy to the world's economy, and have been utilized in power generation, transportation, agriculture, manufacturing, land use and other activities. For instance, petroleum, diesel and gas are used to power plants to generate electricity. But beyond public electricity generating power plants, Nigeria and other few developing countries in the world rely more on the use of generators to generate household and industrial electricity supplies. Nigeria is the largest importer of electricity generators in the world. The bulk of global transportation system relies on fossil fuels. Most vehicular devices (motor vehicles, marine and air transportation) depend heavily on either petroleum, or diesel, aerosol or gas. Similarly, the manufacturing sector of the economy, especially in the developing economies with poor access to electricity, relies of fossil fuels. All these sources of human and economic activities therefore emit sizeable yield of CO_2 and other deleterious gases. (Fagbemi and Idoko, 2009).

The Loyal Society (2019) posited that the Sun helps as the main energy source for Globe's climate. Some of the received sunlight is replicated directly back into planetary, particularly by bright sides such as ice and clouds, and the rest is immersed by the surface and the atmosphere. Ample of this absorbed solar energy is re-emitted as hotness (longwave or ultraviolet emission). The air in turn absorbs and re-radiates hotness, some of which outflows to space. Any disorder to this balance of incoming and resigning energy will disturb the climate. For instance, lesser changes in the production of energy after the Sun will affect this balance nonstop. Humans also upset climate by altering the environment of the land shells (for instance by dissipating forests for farming) and the complete emission of pollutants that affect the amount and type of particles in the atmosphere. Scientists have determined that, once all human and natural influences are considered, earth's climate balance has been changed towards heating, with the major contributor being increaseoutcome of this process and re emission of long wave back to the earth's surface increase the amount of heat energy in the earth's climatic system. Human movement is changing the amount of greenhouse gases in the atmosphere in three respective and significant methods, namely;

The process of burning fossil fuels

Carbon dioxide is one of the central conservatory gases and givers to the greenhouse effect. When fossil fuels for instance coal, oil and gas burn, they discharge greenhouse gases.

The issue of Deforestation

Deforestation is the process where forests are cut down quicker than they are substituted is a major provider to climate change. This causes 20 percent of the biosphere's carbon emissions. Deforestation marks such an enormous role to carbon emissions since trees absorb CO2 as they grow.

The pattern of Explosion in Population

As the world's populace rises, there are many individuals who want food, livestock and energy. This augmented demand clues to

increased emissions. Precisely, population, income, and economic growth could all affect the harshness of climate change impacts in relations of food security, hunger, and nutritional adequacy.

Table 1 showing the effects of climate change on regions

S/NO	Climate Changes on Region	Effects/ Consequences
1	Africa Region /Areas	It involves in the change of the level of rainfall, decrease in the pattern of crop yield, degradation of land, it leads to food insecurity, reduction of water resources, high drought, desertification, serious flooding, sea level rise of salt water which distort coastal areas, poor nutrient, destruction of shelters, and challenge of national security.
2	Asia Region / Areas	Serious increase in drought, decrease in soil moisture, challenge of flood, vanishing forest, policy crisis.
3	Latin America Region /Areas	The High increase in tropical windstorm, High level of drought, flood, policy effect, exposure of coasts.

Source: Survey reports (2020).

Global Climate Change Adaptation and Mitigation Strategies

Okunmadewa (2008:218) studies showed that in planning strategies for tackling the potential problems of climate change a two-prong approach should be pursued. These are (1) strategies for averting the change, and (2) strategies for mitigating the effects of the change.

Strategies for averting climate change (called preventive options) fall into three categories: (1) those for reducing the demand for fossil fuels, especially by conserving and using alternative energy source, (2) those which adopt technical solutions to collect and control carbon dioxide emissions and, (3) those which involve increasing biomass production including re-a forestation of denuded areas. Strategies for mitigating the effect of climate change include measures that protect (protective options). For example, the application of technical, engineering or structural responses and those that will help to increase man's resilience (adaptive options) to the effect such as relocation, improved water and soil management, application of new agro-technology, improved land-use policies, maintenance of food reserves and the introduction of disaster relief measures. Other adaptive strategies are those that lead to improved choices. These include measures employed for (1) environmental monitoring and early warning systems, (2) acquiring and applying improved climate data, (3) providing public information and education, and (4) investing in the transfer and use of appropriate science and technology.

Al Gore (1992) mitigating climate change involves taking actions to reduce climate change or greenhouse effect, some of these measures that can be taken to mitigate climate change include;

- Research into geo-engineering to produce more environmentally friendly engines or machines.

- Transport and automobile industries should make cars with less carbon-dioxide emission.

- The World nuclear power operators should be encouraged to desist from activities that will continue to deplete ozone layer.

- Encourage reforestation and discourage deforestation and bush burning.

- Integration of climate issues into economic planning and management at both national and regional levels.

- Frequent campaign against climate change and increase in awareness campaigns on climate change and maintenance of environmental sustainability.

- Replace incandescent light bulbs with compact fluorescent bulbs which produce less heat (Ojemade, 2012:42).

Egbule, Agu, Neadib & Chukwuone (2011:21) found out the following adaptations of climate change, they include; Planting cover crops like melon to help conserve soil moisture; Mulching and use of organic manure; Early planting with first rain especially for crops like maize and cassava as cited in Okolie, Ossai and Eze (2013: 53).

Research Framework

This research framework employed the human security paradigm as its theoretical analysis. The framework was fully adopted by Mahbub ul Haq in 1994, during the United Nations Development Programmes under the Human Development Report.Basically, human security involves all the measures used in protecting the individuals at any point in time towards its success in the world.

According to Gomez and Gasper (2014: 2) the human security approach broadens the scope of security analysis and policy from territorial security to the security of people. The 2012 GA Resolution stresses the role of "Member States in identifying and addressing widespread and cross-cutting challenges to survival, livelihood and dignity of their people". In other words, threat(s) to – and values under threat in – people's lives are the key starting point of a human security report.

The 1994 HDR highlighted two major components of human security: 'freedom from fear' and 'freedom from want'. These freedoms, from the preamble to the Universal Declaration of Human Rights, are part of the four human freedoms that President Franklin D. Roosevelt famously referred to in a speech in 1941. He was advocating a world founded on: freedom of speech and expression, freedom of worship, freedom from want and freedom from fear.2 Subsequent debate in the 1990s added the freedom 'to live in dignity' (cited in Idoniboye-Obu and Sapele (2018: 5).

In applying this framework, the theory revealed that the essentials desires of safety as per the individuals concerning an enhanced living and a purposeful humanity would be realized when there is an effective and efficient approach to human security system. However, securing the individual is essential for straight development and a basis to device the convention and the protocol actions. The human security approach is pertinent for the reason that it drives in inspiring the states globally to emphasis only on the individuals concerning an enhanced society and in opposing the effect of climate change globally. In additional, this framework disclosure the widespread threats connected to greenhouse radiations and in what ways the individuals are in anguish from the negligence of the adherence to existing laws connected to established frameworks and strategies for the global climate change adaptation in the world.

Human security approach showed the need of individuals for a secured life towards the global world. The overall goal of people in the world is to see the wellbeing of their lives in a balance and secured conditions. And this will bring globalization easy in the course of man efforts in society.

To also reveal the relevance of human security for the persistent issue like climate change in the global system. Human security is use as a foundation to understand the level of interactions among peoples to which human could be applied as a model in determining a vision in the global system and the adoption of climate change mitigation. This shows that global climate change is human factor and its

activities are surrounded by individuals that need human solution to curb it menace within the global context.

Research Methods / Techniques

The research employed purely on secondary sources in collecting the data and the methodology adopted was on qualitative approach and it uses content analysis since the study has been a global and contemporary issue that affects every individual. The design used in the study was descriptive in nature to ascertain the impact of climate change globally.

Findings / Conclusion

Findings showed that climate change has become a global issue which greatly affects globalization and that environmental humiliation, desertification caused by climate change had greatly retarded agricultural production and government policies globally. Climate change has led to many challenges across the world and these are; increased food insecurity, poor statistical analysis and implementation by government, pastoral crises in some of the states, poor funding of the institutional frameworks by the various governments.

The study also observed that several research have credited natural, human actions or together as contributing reasons of the global climate change. That is, logically, the climate goes over diverse series of in constant interval, flashing among cold and warm times. The globe has gone through numerous stages of warming and cooling above the last thousands of years. The warm time indisputably has greatly retarded the growth of agriculture and the common practice of animal husbandry. Nonetheless, the compromise between numerous researchers in the past few years recognised the reason for most important global warming to human intrusion with the climate structure and system.

However, at present it is generally established that the keyreason of the current climate change is the radiation of greenhouse gases (GHG), commonly carbon dioxide, the issue of methane, nitrous oxide in huge amounts by human events. These human events, actions comprise of the main issue of agricultural production, mechanisation, sweltering of fuels and deforestation, main wetland degradation and so on. In addition, global climate change also faces the issue of gases which respond with the ozone layer and it helps to defend the earth through the sun's emission. It was also showed that agriculture activities contribute greatly and deforestation accounts severely to the greenhouse gases emissions to global climate change. And these GHG emissions are confiscated to the real oceans, forestry and swamplands, soils NO3 and it helps to assist as carbon sinks.

Recommendations

The study recommends the following measures to curb the contemporary global climate change.

1. The paper recommends that government should provide alternative means like renewable energy, reduction of industrial carbons in tackling the menace of climate change globally.

2. There should be reduction of emission of greenhouse gases by stopping deforestation, the use of high yield and disease tolerant crops, and also crops adaptable to high level of weather conditions.

3. There should be general awareness and easy ways in accessing data on climate change effects to the public consumption

4. Government and private sectors should continue to fund effective and rigorous research on the global climate change adaptation strategies.

5. States in the international system should encourage several collaborations/ partnerships on the persistence dangers of climate change

6. There should be a monitoring mechanism with a special global fund put in place for tackling global climate change.

Conflict of Interest

The entire research of this work was carried by the authors and there is no form of conflict of interest by any means. Also, all the authors made meaningful contributions extensively towards this study.

References

Adejuwon, S. A. (2004). *Impact of climate variability and climate change on crop yield in Nigeria* (pp. 2-8). Contributed paper to Stakeholders Workshop on Assessment of Impact and Adaptation to Climate Change. (AIACC).

Al gore, B. (1999). *Earth in the balance*. Boston: Houghton Mifflin Books.

Edeh, H.E., Leo-nnoli, T.C & Eme, I.O (2014). The political economy of climate change in Africa. Nigerian in perspective. *Arabian Journal of Business and Management Review (Nigerian Chapter).* 2(7), p.18.

Fagbemi, S., & Idoko, C. (2009), "40 million Nigerian youths unemployed – FG – Plans summit on youth unemployment – 80% Nigerian graduates unemployable – Education Minister", February 25.

Food and Agricultural Organisation. (2008). *Expert meeting on global perspectives on fuel and food security.* Technical Report, February 18-20, 2008, Rome

Gregory, P.J. A, Ingram, J.S.I, and Brklacich, M. (2008). *Climate change and food security Transactions of the Royal Society*: *Biological Sciences*, 360. Accessed on 25/07/2019 from http/idx.doi.org/10.1098/rstb.2005.175. p.2139-218.

Idoniboye-Obu, S.A & Sapele, F.F (2018). Impact of climate change on food security in Nigeria. *Paper Presented at the Niger Delta University Climate Change Conference, November, 2018*.

Inter-governmental Panel on Climate Change, (2007). Synthesis Report. Fourth Assessment Report: Climate Change 2007.

Okebukola, P., & Akpan, B.B. (2009). Recent development in climate change. In Uzewi U and Uzoechi U (eds). *Strategies for environmental Education: Focus on recent developments in climate change. Environment Education series*. No. 13. Ibadan: Stan. p.1-22.

Okolie, C.A, Ossai, N.O & Eze, C. (2013). Mitigation of and adaptation to climate change in the 21st century. *International Journal of Research in Arts and Social Sciences*. 6(1). p.8.

Speranza, C.I. (2010). Resilient *adaptation to climate change in African agriculture*. Bonn: German Development Institute (DIE).

Terson, I.J.K and Ogochukwu, I.J. (2014). The implication of climate change on food security in Nigeria. *Journal of Good Governance and Sustainable Development in Africa*. (JGGSDA). 2(3), p.36.

United Nations Framework Convention on Climate Change, (2005). Article – 1(Definition). Full Text of the Convention.Accessed on 20/07/2019*https://unfccc.int › resource › docs › convkp › conveng*

Uzoechi, B.U. (2009). Human impact on the global environment. In Nzewi U and Uzoechi U (eds). *Strategies for environmental education. Focus on recent developments in climate change. Environment education series*. No.13, Ibadan: Stan.p.23-36.

Science for a Healthy Planet and Safer World (2019). Global Warming Impact. Accessed on 15/08/2019 from https://www.ucsusa.org/our-work/global-warming/science-and- impacts/global-warming-impacts

The Royal Society (2019).*The basics of climate change***.** Accessed on 20/08/2019from https://royalsociety.org/topics-policy/projects/climate-change-evidence-causes/basics-of- climate-change.