

**Economic Implications of Climate Change and the Imperative of
Re-Directing Financial Resources in Nigeria**

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Abstract

Nigeria like other countries of the world is faced with the challenges of ensuring sustainable environmental development through economic policies and governmental activities. According to the Organization of Economic Cooperation and Development (OECD), economic dangers and losses arising from climate destabilization could cause the global economy up to \$970 billion. This paper therefore examined the economic implications of climate change in Nigeria. Relevant literature was reviewed and secondary data was collected. Based on the available information, it was recommended that government and its agencies should utilize effectively the available financial resources and embark on environment friendly projects and activities in order to achieve sustainable development.

Keywords: Economic implications, Environment friendly projects, Sustainable development

Introduction

Climate change has taken centre stage in the world as different stakeholders such as Geographers, Accountants, Bankers, Engineers, Educationists and Agriculturists ever than before now focus on the phenomenon its impacts. Climate change has become a new reality. It brings with it changes in weather patterns that can have serious repercussions lives and properties; upsetting seasonal cycles, harming ecosystems and water supply, affecting agriculture and food production, causing floods, landslides, drought and famine as weather becomes fierce (Kasperson & Kasperson, 2001). All these have serious socio-economy consequences. For instance, as a result of climate change malnutrition and disease become common occurrences.

Nigeria's economy though heavily dependent on oil is sustained by agriculture and has thus become increasingly constrained. Both pillars of the economy are vulnerable to climate change crisis. Sustainable development of these sectors of the economy can only be achieved if processes in use are in harmony with the environment. Although, Nigeria is not a major player in the green house gas emission compared to the western countries, the country has contributed to the depletion of the ozone layer through continuous gas flaring emission by multinational oil corporation in Niger Delta region.

The Oxford Advanced Learners' Dictionary (2008) defined Climate to mean the regular pattern of weather conditions (temperature, amount of rain, wind etc) of a particular place. According to Nasiru

(2009), climate change refers to a change in weather condition that is attributable directly or indirectly to human activities that alter the atmospheric compositions of the earth which leads to global warming. Climate change has become a reality as it brings with it, changes in weather patterns that can have serious consequences such as upsetting seasonal cycles, harming ecosystems and water supply, affecting agricultural farming systems, food production and causing sea level rise. Climate change causes flood, landslides, drought and famine. As weather becomes fiercer and storms increase in frequency and intensity, serious socio-economic consequences result. Climate change has a cumulative effect on natural resources including agricultural resources and the balance of nature and its effects on Nigeria are characterized by delay in rainfall, excessive heat, heavy down pour and outbreak of diseases.

Okali (2004) identified the factors responsible for Nigeria's high vulnerability to climate change as Geographical characteristics (Nigeria lies between 4°N and 14°N and between 3°E and 15°E and spans 6 major generation zones reflecting highly variable climate throughout the country; limited capacity to adapt due to low level of awareness, inadequate financial resources and institutional and technological capability; economic dependence on climate sensitive resources (agriculture employs 70% of the workforce); high population density, general food insecurity issues and serious social tensions; and heavy concentration of GDP generating industry in locations that are highly vulnerable to climate change like Lagos and the Niger Delta.

More than 800 million people in tropical and sub-tropical countries are currently food insecure (United Nations Organization, 2010). The situation of the affected is expected to worsen, and the number of food in-secured people is likely to increase due to extreme weather condition. Climate predictions and analyses of past and current trends indicate that small-scale farming households in tropical and sub-tropical areas will be exposed to increase climate change. In the absence of measure at the local, regional, national and international levels to better adapt agriculture to the effects of climate change, and where appropriate to mitigate climate change with different agricultural practices food insecurity in tropical and sub-goals will be further delayed. The Millennium Ecosystem Assessment [2005] established that agricultural intensification has not met the rising demand for food in most part of the world, but that significant tradeoffs have been associated with these increases.

In particular, the water cycle, nutrient cycling, biodiversity and carbon sequestration have been negatively affected, whilst the emission of greenhouse gas and habitat fragmentation have increased. In turn, this environmental degradation exacerbates some of the drivers of climate change and further undermines the sustainability of agriculture the IPCC climate change 2001 assessment stresses that most of the research on agriculture and climate change has focused on the impact of climate change on crop yields. This has provided an excellent foundation for assessing how climate change may affect crop productivity in different regions. The linkages between these analyses and the broader issues of sustainable development and food security in country suffering from extreme poverty and malnutrition are, however, not sufficiently understood. These include the linkages between the impacts of climate change on agricultural productivity, natural resources and ecosystem and agro ecosystem resilience in tropical and sub-tropical countries.

Causes of climate change

The climatologists have found evidence to suggest that some factors are primarily responsible for most of the past episode of climate change on the earth. These factors include:

(a.) Non- radioactive forcing

Any change in the climate must involve some form of energy redistribution within the global climate system. Yet there are forcing agents who do not affect directly the energy budget of the atmosphere (the balance between incoming solar radiation and outgoing terrestrial radiation). These are considered to be non- radiative mechanism of global climate change. Such agents usually operate over

vast time scales [107 to 109] and mainly include those which affect the climate through their influence over the geometry of the earth's surface, such as location and size of mountain ranges and position of the ocean basins.

(b.) Radioactive forcing

A process which alters the energy balances of the earth-atmosphere system is known as radioactive forcing mechanism (Shine et al, 1990). These may include variation in the earth's orbit around the sun, solar radiation, volcanic activity and atmospheric composition. Associating a particular cause with a particular change, however, is extremely difficult as the interlinked nature of the climate system ensures that there are feedbacks. A change in one component leads to a change in most, if not all, other components.

(c.) External forcing

This section discusses some of the various external forcing mechanism operating over time a scale of 10 years to 109 years.

(i.) Galactic variations

The orbit of the solar system about the centre of the galaxy has been considered as a possible external climate forcing mechanism (Hugget, 1991). During the course of a galactic years [now estimates at 303million years] variation in the inter stellar medium (William, Isaac and Shoo, 1975) may also suggest that variation in gravitation torque induced by galaxy's near neighbors, the small and large megellanic clouds, could have far reaching consequences for the earth's climate.

(ii.) Orogeny

It is the name given to a tectonic process of mountain building and continental uplift. Such mechanisms operate over tens or even hundreds of millions of years. The earth's outer surface, a layer known as the lithosphere {made up of the crust and the upper section of the mantle}, is broken up into 12 different plates which are constantly adjusting their positions relatively to each other and such movements are driven by the internal convective dynamics within the earth mantle. When plates collide, one may either be subducted beneath another or both are pushed continually together, forcing upwards any continental land masses, to form long mountain range.

(iii.) Epeirogeny

It is a term that describes changes in the global disposition of land masses and like organic process, this changes are driven by internal plate tectonic movements. Continents move around the globe at a rate of several centimeters per year owing to the slowness of the internal dynamics of the earth. However, over tens or hundreds of millions of years, both the size and position of land area can change appreciably. At times in history; there had been super continents in which all the continental plates were locked together in one area of globe. The last of this occurred about 250 million years ago, and is named Pangaea. Since that time the continents have gradually moved apart, the most recent separation occurred between Europe and North America, during the last 60 to 70 million years. What is now the Pacific Ocean used once to be the vast expanse of water called Panthalassa Ocean that surrounded Pangaea.

(iv.) Volcanic activity

Explosive eruption can inject large quantities of dust and gaseous materials [such as sulphur dioxide] into the upper atmosphere [the stratosphere], where sulphur is rapidly converted into sulphuric acid aerosols. Whereas volcanic pollution of the lower atmosphere is removed within days by the effects of rainfall and gravity, stratospheric pollution may remain there for several years, gradually spreading to

cover much of the globe. A volcanic activity has the ability to affect global climate on a longer time scale. Over periods of millions or even tens of millions of years, increased volcanic activity can emit enormous volumes of green house gases, with the potential of substantial global warming (Pickering & Owen, 1994; Rampino & Volk, 1996]. However, the global cooling effect of sulphur dioxide emissions will act to counter the green house warming and the resultant climate change remains uncertain.

(v.) Ocean circulation

It was identified that the oceans store an immense amount of heat energy, and consequently play a crucial role in the regulation of the global climatic system. In order to explain the observed hemispheric synchrony of glaciations, despite periods of directly opposed orbital forcing in the two hemispheres, many researchers have looked to the oceans. Although, in this sense, changes in oceans circulation has traditionally been viewed as internal forcing mechanisms in its own right.

(vi) Variation in atmospheric composition

The changing composition of the atmosphere, including its green house gas and aerosol content, is a major internal forcing mechanism of climate change. Through the burning of fossil fuels, forest clearing and other green house gasses human beings have contributed to climate change. Certain atmospheric gasses, like carbon dioxide, water vapors and methane, are able to alter the energy balance of the earth by being able to absorb long wave radiation emitted from the earth surface. The net result of this process and the re-emission of long wave to the earth surface, increase the quantity of heat in the earth's climate system. The average global temperature of the earth would be a cold -18 Celsius rather than the present 15° Celsius. Scientists believe that the world is already experiencing global warming due to an enhancement of the greenhouse effect. Most computers climate models suggest that the globe will warm up by 1.5 – 4.5° Celsius if carbon dioxide reaches the predicted level by the year 2050.

Economic implications of Climate change

The economic estimates of the impact of climate change are typically based on 'damage function'. The estimates cover a variety of climate impacts that are usually grouped as 'market impact' and 'non-market impact'. Market impacts include effects on climate sensitive sectors such as agriculture, forestry, fisheries and tourism; damage to coastal areas from sea level rises; changes in energy expenditure (for heating and cooling) and changes in water resources. The non-market impacts cover the effects of climate change on health; leisure activities, ecosystem and human settlements. The economic implications of climate change in Nigeria are discussed below:

(a.) Agriculture, Forestry and Fisheries

McCarl (2007) reported that 70% of the workforce in Nigeria relies on rain-fed agriculture for their livelihood. He noted that agriculture is affected by climate change as a result of consequential reduction in quantity and quality of yields; changes in crop practices through changes in water use (irrigation) and cost of agricultural inputs such as herbicides, insecticides and fertilizers; Environmental effects particularly due to frequency and intensity of soil damage leading to nitrogen leaching, soil erosion and reduction of crop diversity. Other effects are adaptation of organisms and plants to flood, salinity and temperature, collapse of flourishing profitable investment and a sharp downturn of national economy. According to Okali (2004), droughts usually increase in occurrence, having a huge impact, especially in the dry North as a result of desertification. The humid South may not be directly affected by precipitation but it is usually adversely affected by temperature increase. Forestry, especially in the Central and Northern regions is usually affected by increasing forest fires from drought. Climate change reduces the potentials for irrigation, promotes low soil moisture and depletes soil fertility.

(b.) Tourism and Leisure activities

The forest is the abode for wildlife. If the forests disappear, the wildlife goes with it. Sites of tourist attractions in Nigeria are vulnerable to climate change. The waterfalls, the lakes, the river basins, the ocean views, the beaches, the ranches etc. may be nowhere to be found. Due to this, the huge investment of both the government and the private sector in tourism and leisure activities may be eroded. Loss of revenue and the lay-off of those employed in this sector of the economy will impose financial strain on the economy.

(c.) Coastal areas and Sea level rises

Not less than seven out of the thirty-six states in Nigeria is in the coastal area. Nigeria's coastal zone is richly blessed with various natural resources such as crude oil and fish, which are presently being exploited for economic gains. The global climate change and the concomitant sea level rises will have adverse effects on the coastal zone. Nigeria could lose over 18,000 square kilometers of the coastal land and the natural resources contained therein as well as experience disruption in socio-economic activities. This will also increase the salinity of the fresh water, thereby affecting aquatic life. Loss of revenue and GDP and the attendant impact of rendering the inhabitants of the coastal areas, who are pre-dominantly fishermen, unemployed.

(d.) Human settlement

Desert encroachment is becoming a threat from the northern part of Nigeria due to desertification. The inadequate trees in some parts of the North have resulted in unfavourable living condition and displacement of many human settlements. The rising sea level and gully erosion are equally claiming several kilometers in the coastal areas especially the southern part of the country. Valuable resources and infrastructures of the country are in this area and if the sea claims these places, the economy of the nation will be in jeopardy. The Tsunami incidence in Japan on 12th March 2011, which claimed thousands of lives and properties worth billions of dollars, is a warning signal. It is also very important that Nigeria lend a clue from the bitter experience of Japan.

(e.) Health

Increased temperature in the various regions could result in high incidence of malaria and other diseases that affect humans due to high temperature. The possibility of water-borne diseases as a result of the sea level rises cannot be ruled out. The implication of this is that there would be an increase in the cost of maintaining a healthy nation. It is note-worthy that this might frustrate the recent effort by government and relevant international health agencies to halt the scourge of malaria and other diseases.

(f) Industry and manufacturing

The effect of global warming on the climate-vulnerable sectors of the economy (agriculture and the coastal resources) that provide input for the industry and manufacturing is another area of concern. The infant industries and the small and medium scale enterprises could be threatened. This is because only the big ones will be able to pay the high prices of manufacturing inputs. The GDP will be adversely affected by the inability of the small businesses to operate since they act as catalysts for economic growth and development.

(g) Financial services sector

This sector serves as the intermediary between the deficit sector and the surplus sector of the economy. Owing to the ability of the big companies who are mostly quoted on the stock exchange to weather the storm of the likely downturn, they will force the market into an initial boom, which may not last, only to be followed, subsequent to its effect on the climate sensitive sectors, by a devastating and catastrophic burst because no entity or segment of the economy would be left out. Hence, there is the tendency of experiencing what could be best described as ‘climate induced inflation’. Odjugbo (2010) noted that climate has a significant effect on the country’s economy. He evidenced this finding by analyzing the total cost of damages caused by winds and rain storms in twelve selected states in Nigeria. These states are Lagos, Delta, Ondo, Imo, Kwara, Adamawa, Plateau, Benue, Sokoto, Katsina, Bauchi and Yobe States.

Table 1: Spatial variation of cost of damage by wind and rain storm

State	Lagos	Delta	Ondo	Imo	Kwara	Adamawa
Damage cost (N’m)	12,000	11,500	11,000	9,000	8,000	6,000

State	Plateau	Benue	Sokoto	Yobe	Bauchi	Katsina
Damage cost (N’m)	5,000	8,000	3,000	3,000	4,000	5,000

Conceptual framework

Climate change refers to variation in climate that is attributable directly or indirectly to human activities, that alters the atmospheric composition of the earth which leads to global warming. The total mass of the hearth’s atmosphere at a natural background level, calculated according to their relative volumes are nitrogen 78.09 percent; oxygen 20.95 percent; argon 0.93 percent; carbon dioxide 0.03 percent; and minute traces of neon, helium, methane; krypton, hydrogen, xenon, and ozone. Any alteration in statistical distribution of weather over a period of time that ranges from decades to millions of years as may be caused by the inter-planetary or human factors is called climate change (Okorodudu-Fubara, 1998). The change has the potential of affecting all natural and human systems and may be a threat to human development and survival socially, politically and economically. Global warming is the increase in the average surface temperature of the earth due to climate change. Global warming can lead to the rise in sea levels. As oceans warm and glaciers melt, thereby threatening agriculture productivity and human settlements. Other impacts may include; change in rainfall patterns and exacerbation of soil erosion, storms, floods and drought. The ultimate result would be a deepening in food crisis, weather, energy and the general environment throughout the world.

Theoretical framework

Nigeria’s economy is mono-cultural and heavily dependent on the oil sector, which accounts for about 80% of the government revenues, and over 90% of foreign exchange earnings. Currently, the Nigerian government is in the process of lessening this unhealthy dependence on crude oil through its development of the natural gas industry. Nigeria currently flares 7.5% of the gas it produces and re-injects 12% to enhance oil recovery. But the development of the natural gas sectors intended to stem this wastage as well as further expanded the government revenue base. Despite this diversification attempt, however, Nigeria economy still depends on fossil fuel; this is particularly worrying because fossil fuels are the chief culprit implicated in the environmental issues such as climate change.

Human activities in oil and gas industry in Nigeria has contributed to an increase in the concentration of green house gases in the atmosphere leading to green house effect, which in turn is expected to result in climate change. The green house gas resides in the atmosphere allows the wave radiation from the sun to penetrate the atmosphere. The developed countries are channeling huge resources into research and development of alternative and renewable energy source that would enable

the transition away from fossil fuels; signaling a resolve to transit away from the fossil fuel economy. Likewise, government policies and regulations are providing incentives to the private sector to expedite this shift. For instance, Denmark put in place energy tax levies aimed at restructuring the power markets. In Netherlands, under the subsidized market investment cost for wind power were subsidized by up to 40% and translated into an increase in capacity to 120WM of installed wind power in 1996. In United Kingdom, the non-fossil fuel obligation [NFFO] requires regional electricity companies in England and Wales to secure specified amount of electricity from renewable energy source. These are just to demonstrate that action are already been taken to curb the use of fossil fuels in developed countries.

Despite the negative implications of climate change response measures for Nigeria economy, it is appealing that there is no visible demonstration of the preparedness of the government to tackle this issue. For instance the blue print for Nigerians development vision in 2010 did not address the issues related to climate change or provided strategies on how to tackle the problem.

Conclusion

Nigeria cannot afford to be left outing the fringes of achieving environmental sustainability, alleviating poverty and reducing extreme hunger in line with the millennium development goals. The Government of Nigeria must as a matter of expediency treat the problems associated with climate change on the economy with urgency by adhering to international environmental treaties and embarking on massive and aggressive sensitization of the citizens on the problems associated with global warming and the steps that can be taken to address the concern. The government needs to sensitize Nigerians on the need to be more environmental friendly, evolve a change in consumer behaviour and ensure effective utilization of financial resources to mitigate the effects of climate change.

Recommendations

Responding to climate change, as contained in article 2 of the UNFCCC encompasses two strategies (a.) mitigate: controlling greenhouse gases to stylize climate change at an acceptable limit, and (b.) adaptation: adjustment to the impact of climate change given existing levels of greenhouse gases in the atmosphere. However, low technical skills, low research capacities, insufficient or lack of institutions able to deal with adaptation, inadequate policies and ineffective governance, have been identified as important limits to Nigeria's adaptive capacity (Ewah, 2007).

Nigeria can address the challenges that are related to climate change through re-directing and appropriate utilization of available financial resources and accountability. In line with this submission, the following recommendations are considered relevant:

- i. Encouragement of environmental friendly behaviors through availability of kerosene and cooking gas at affordable prices to prevent cutting of trees for firewood.
- ii. Provision of funds for capacity building on adaption to climate change, which involves changing people's mindset and behavior and acquisition of relevant technologies and skills. This encompasses scientific and research capacity, strengthening the most vulnerable communities with respect to identifying the most vulnerable base on their own socio-economic needs. Assist them to be able to cope with future impact of climate change.
- iii. Embarking on sustainable energy investment and governance that renders policy effectiveness in the areas of public finance.
- iv. Nigeria should begin to implement the recommendations of International treaties to which Nigeria is a signatory. Nigeria should implement the Kyoto protocol.
- v. The introduction of climate insurance policy for the coastal settlements is essential in order to compensate for the potential losses that could be incurred as a result of climate change.
- vi. The maintenance of national food reserves to provide against any eventuality of food shortage.
- vii. Investment in research to discover climate-adaptive high yield crops.

- viii. Climate economic risk diversification through investment in non-climate vulnerable sectors and
- ix. Distribution of industries across the six geopolitical zones in Nigeria and relocation of some important and vital economic agencies away from the coastal areas.

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