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**The Climate Change Challenge in Africa:- Impacts, Mitigation and Adaptation**

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**Abstract**

Climate change is now a reality, and is already having devastating effects on the natural environment and human populations across the world. Many studies (Maathai, 2006; UNFCC 2006; CCDI 2007; IPCC 2007 and UNDP 2009) have confirmed that Africa contributes the least to global warming but the region is the most vulnerable and most adversely affected by climate change. Unpredictable rains and floods, prolonged droughts, subsequent crop failures and rapid desertification among others have in fact already begun to change the face of the continent. Africa's poor and vulnerable will be particularly hit by the effects of the rising temperatures. This paper examines the problem of climate change in Africa; its impacts, mitigation and adaptation measures are equally investigated. The paper explains that neither mitigation nor adaptation alone can avoid significant impacts but together they can compliment each other and reduce significantly the risks of climate change. Finally it concludes with recommendation to African Countries to enable them reduce vulnerability and increase capacity to adapt while suggesting the need to integrate climate change concerns into all planning whether it be infrastructure, education or health.

**Keywords:** Climate Change, Challenge, Mitigation, Adaptation.

**JEL code:** Q54

**Introduction**

There are many theories that try to explain climate change but none of them can give a complete explanation of all the changes. The main problem is the relationship and interactions among the physical components of the climate system. Some possible causes of climate change include:- Variations in solar output; variations in the earth's orbit; surface modification; variations of land surface albedo due to vegetation; climate modification in the urban environment; and variation within the Atmosphere which are caused by the greenhouse effect, particles in the atmosphere and volcanic eruptions. However the dominant factor has certainly been the increase in greenhouse gases.

Climate change resulting in air global warming for instance is visible in increases in air and sea temperatures, melting snow and ice and rising sea levels. All regions are getting hotter; the wet areas are getting wetter and the dry areas are getting drier.

According to Peter Smith (2004), the likely rise of sea level this century is on average, about half a meter, which will have a significant impact. A large percentage of Africa's population is land- locked and coastal facilities are economically significant. In Nigeria for instance, more than 20 million people live along the coastal zone.

Nigeria's extensive coastline is already being threatened by sea-level rise and human development, which in combination contribute to degradation and loss of coastal wetlands and

mangroves and increasing damage from coastal flooding with serious consequences for fisheries, buildings and tourism.

According to the office for coordination of Humanitarian Affairs (OCHA), nine out of every ten disasters are now climate-related. Recorded disasters have doubled in number from 200 a year to more than 400 over the past two decades. In 2007 alone, an unprecedented 15 funding appeals for sudden natural disasters were issued. All but one resulted from climatic events.

Thus globally, climate change has become a front burner issue. The recent pointers to this effect became obvious in the past G8 meeting where climate change was the foremost issue over and above the global economic melt down.

There is now physical and scientific evidence that the climates of the world are changing. Evidence include global rise in sea levels, drought and increasing desertification, drying of water resources (rivers and lakes), inundation of coastal lands by sea water, increase in ambient temperatures and changing climatic seasons.

It remains unclear however, what the character of the new climates will be when fully established. But there is no longer any major contention to the fact that climate change is a serious threat to Sustainable development globally and in Africa in particular. And there is a real risk of Africa becoming the forgotten continent in the context of the fight against climate change. This is the importance of examining the impacts of climate change in Africa and the way forward is more urgent now than ever before. This is what this paper seeks to address.

### Literature review

#### Climate change impacts

The impacts of climate change are already taking their toll in Africa. It is a clear threat to all sectors of our socio-economic development and the achievement of the Millennium Development Goals. These impacts include:-

**Ecological Impacts:-** Climate Change and its effects on aspects of the various vegetation zones could shift these zones and the wild life

they support in them, and any changes in the forests are likely to be worsened by human competition for land.

Africa is home to five internationally recognized areas of particularly high species richness and endemism known as “biological hot spots”. The continent has a large and diverse heritage of Flora and Fauna. It contains about a fifth of all known species of plants, mammals and birds, and a sixth of amphibians and reptiles.

Savannahs, which are the richest grasslands in the world, are the most extensive ecosystem in Africa. According to CCDI (2007), Africa’s biodiversity is currently under threat from natural and human pressures. Climate change will be an additional stressor and may lead to changes in habitats causing species migration or extinction for both flora and fauna. Sea level rise will threaten coastal areas which are already vulnerable because of over-exploitation of coastal resources, over population and pollution.

#### Socio – Economic Impacts

Climate change and sea level rise would affect the basic elements of life for people around the world particularly in Africa. According to Ojo (2007), it would have a lot of impacts on water resources and water resources management as higher temperatures would increase the rate of evaporation and evapo-transpiration and also increase the risks of drought and desertification processes especially in the Sudano – Sahelian areas. With water shortages in the reservoirs, there could be considerable financial implication and socio – economic consequence.

Also, climate change in Africa is expected to be accompanied by greater variability in rainfall and temperatures, which would result in more frequent floods, droughts and larger runs of wet and dry years which would have direct impact on Agriculture and livestock production.

According to IPCC (2006) Report, yields from rain – fed agriculture in some African countries could be reduced by up to 50% by 2020. Local food supplies are projected to be negatively affected by decreasing fisheries resources in large lakes due to rising water temperatures,

which may be exacerbated by continued over – fishing. Increased ocean temperatures and sea level rise would affect fisheries & mining causing a reduction in fishing activities, climate change would also significantly affect tourism, transport, industry human population and settlements. The Stern Review (2006) estimates that if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimate of damage could rise to 20% of GDP or more.

### **Energy Impacts**

Changes in the amount of precipitation and variations in humidity, wind patterns and the number of sunny days per year could affect both consumption and production of energy. For example, there could be significant impacts on energy demand due to higher temperatures and humidity consequences, which would raise the demand for air- conditioning during the day. Also power poles and lines could be damaged as result of strong, gusty winds and thunderstorms. Reduced precipitation would adversely affect the supply of hydroelectric power and other types of energy production. Facilities located along coastal areas of Africa such as power plants and oil & gas production facilities could be damaged from sea level rise.

### **Health Impacts**

The human health impacts of climate change in Africa would occur in various ways, for example through direct ways (e.g. illness, injuries and deaths from heat waves and from extreme weather events, floods, storms, fires and droughts) and indirect ways (e.g. changes in the range of vector-borne diseases. Africa is expected to be at risk primarily from increased incidences of vector and water borne diseases and reduced nutritional status. A warmer environment could open up new areas for malaria; altered temperature and rainfall patterns also could increase the incidence of other diseases, especially in areas with inadequate health infrastructure. Mosquitoes would thrive in warmer temperature, only those countries at risk that have good public health services would be able to manage the threat. A 20<sup>o</sup>C rise in temperature could lead to as many

as 60million more people being exposed to malaria in Africa (CCDI, 2004).

### **Environmental Impacts**

Climate change and sea level rise would have significant impact on sustainable environmental development. Studies indicate that severe reduction has resulted from a combination of reduced rainfall and high demands for water for agricultural irrigation and other human needs.

IPCC report says that by 2020 between 75 and 250million people in Africa are projected to be exposed to an increase of water stresses due to climate change. By 2050 wet areas such as the tropics and high altitude countries will get 10% - 40% wetter. Dry and drought affected areas such as Sub-Saharan Africa will see less Rainfall and get 10 - 30% drier. Presently, of the 19 countries around the world currently classified as water-stressed, more are in Africa than in any other region. This number is likely to increase, independent of climate change, as a result of increases in demand resulting from population growth, degradation of watersheds caused by land use change and siltation of river basins. By 2025, it is projected that around 480million people in Africa will face water scarcity.

### **Socio- Cultural Impacts**

Obviously climate change affects everyone but women are the most vulnerable.

Rural women in developing countries are still largely responsible for securing food, water, and energy for cooking etc. Drought deforestation and erratic rainfall will cause women to work harder to secure these resources. Women, therefore, have less time to earn an income.

### **Mitigation of climate change**

Mitigation measures have to do with limiting and controlling climate change. For example, measures that control the emissions of greenhouse gases which cause the atmosphere to warm.

Existing and emergent technologies, ranging from renewable energy and nuclear power to carbon capture and storage, would be needed to make the reductions in emissions essential if the world in particular Africa is to avoid the danger

in the rise of global temperature. The key incentive here is the price of carbon mechanism; if it is high enough, moving to a low-carbon economy will be a cost – effective measures. Thus the market mechanism makes it expensive to emit carbon and economical to save it.

The key mitigation technological and non-technological practices include the following:

### Technological

**Energy Supply:-** Improved energy supply and distribution changing from use of fossil fuels to renewable energy sources like solar, wind. In Africa, a large amount of its electricity comes from hydropower, which is environmentally friendly in terms of green house gas emissions but rainfall in Africa is variable, and more likely to become so with climate change.

**Transportation:-** More fuel efficient vehicles; increase use of rail transport as against road; increase use of public transport and motorized transport such as cycling and walking. Planning and design of housing layouts should encourage walking, cycling and physical exercise.

**Buildings:-** Significant gains can be made in efforts to global warming by reducing energy use and improving energy efficiency in buildings. To achieve improved energy efficiency in buildings in Africa, expensive high-tech solutions are not appropriate but simple solutions as we have in our Vernacular Architecture that relates building design with climate. These solutions include proper orientation of buildings, sun shading, natural ventilation, form of building, and improved insulation of the building envelope.

Also environmentally-friendly building would produce most of its energy at an on site co-generation plant, capture and re-use waste water and rain water and use recycled materials in its construction.

**Agriculture & Forestry:-** Improved crop and grazing land management to increase soil carbon storage; restoration of degraded lands; improved rice cultivation techniques and livestock and manure management to reduce

CH<sub>4</sub> emissions; improved nitrogen fertilizer application techniques to reduce N<sub>2</sub>O Emissions; dedicated energy crops to replace fossil fuels; and improved Energy Efficiency. Also use of forestry products for bio-energy to replace fossil fuel use with proper forest management, reduced deforestation and increased afforestation and reforestation.

### Non-Technological

Non-technological practices such as changes in lifestyle and consumption patterns can contribute to climate change mitigation and can reduce GHG emissions across all sectors. Management practices can also have a positive role. Public Awareness, educational and training programmes would help to improve acceptance of energy efficiency techniques which would bring about considerable reduction in CO<sub>2</sub> emissions to the environment.

### Adaptation to climate change

Adaptation measures to climate change have to do with living with climate change. Climate change is real and it is no longer possible to prevent it over the next two to three decades, but it is still possible to protect our societies and economies from its impacts to some extent by adaptation strategies. Adaptation measures include the following:-

### Energy

New advancements in more efficient lighting technology, such as Compact Fluorescent Light Bulbs (CFLs) and Light Emitting Diodes (LEDs), promise clean, portable, durable, lower cost, and higher quality lighting. The challenge is to make these products accessible to the millions of the poor in Africa. The idea of meeting energy needs by increasing energy efficiency and wise use of energy instead of increasing energy production is a largely untapped solution to global warming and energy crisis issues.

### Agriculture & Forestry

Adaptation options include water harvesting, management of water outflow from dams, and more efficient water usage. Large scale projects such as the construction of new dams and reservoirs should incorporate small localized efforts like small scale water management

techniques for irrigation e.g. rainwater harvesting. Planting of trees to boost incomes and improve the soil's ability to hold water and protect it from erosion is essential.

### **Coastal Areas**

Adaptation measures in Africa coastal areas include erection of sea walls and relocation of vulnerable human settlements and other socio-economic facilities.

Relocating populations, economic activity and infrastructure would be costly and challenging. In Nigeria for instance, more than 20million people live along the coastal zone; so billions of dollars would be lost economically especially from the oil fields in the area.

### **Methodology**

The survey was conducted only in Nigeria. This study was carried out as a series of 10 focus groups survey in the six geographical-political zones of the country with the aim of examining how best to engage the Nigerian populace in the climate change debate.

The objectives of the survey were to:-

1. Determine the extent of awareness on climate change
2. Determine the perception of causes of climate change
3. Determine the perception of the impacts
4. Assess the country's effort in mitigation and adaptation to climate change

A total of 600 respondents were involved comprising of 10 each from the 10 focus groups in the six geopolitical – political zones of the country. The 10 focus groups are:- Oil industry, Education, Legal, Environment, Commerce, Agriculture, Government, NGO, Manufacturing/ Construction and Journalism.

### **Results & Discussions**

In a scale of 1 to 5 (1 very low, 2 low, 3 Average, 4 High and 5 very high) the respondents average for the extent of awareness on climate change is 2.3 which is low; the

average vote for perception of causes of climate change is 3.1, that for the perception of impacts is 3.3. And 1.4 for the assessment of the country's effort in mitigation and adaptation to climate change.

Some of the issues that are revealed from the results of the survey are:-

- The Awareness of climate change used to be very low in the past few years but due to the efforts of the State and Federal governments the situation has slightly improved. The awareness among the elites particularly the stakeholders is average but generally among all Nigerians is still considered to be low hence the result of the average of 2.3
- Most Nigerians associate climate change with the weather and the resulting impacts of the weather on their environment. Only few of them who are knowledgeable understand causes of climate change greenhouse gases
- Very few Nigerians are taking effective steps to prepare for extreme of weather events caused by climate change and there is little evidence to suggest that steps are being taken to adapt to the effects of climate change. Though the Federal government through its agencies and parastatals are working hard with the collaboration of international agencies on mitigation and adaptation , the awareness among Nigerians is low and hence the necessary participation and co-operation is lacking
- For most Nigerians the environment is not seen as a priority as a result of pressing socio-economic problems and poverty

Finally the findings suggest that climate change terminology is only popular among very few elites and stakeholders, most Nigerians lack vital information which would enable them to better understand and appreciate the climate change problem, and in issue that has the potential to significantly impact their lives.

The effects of Climate change are already overwhelming the populace. Various devastations and cases of flooding, fierce storms and extreme heat conditions are already ravaging the citizens of Nigeria. Loss of farmlands, coastal wetlands and mangroves are no news and there are also serious consequences already on the construction, building and tourism industries to mention a few. There is an increase in deaths, injuries and casualties as this situation worsens by the minute.

Despite the knowledge of these impacts and realities, buildings in Nigeria are still predominantly designed without consideration of the above issues. Many buildings still require a considerable amount of energy for lighting, ventilation and comfort, and much more in this case of rising temperatures and epileptic power supply.

Government policies and sanctions are therefore required in earnest and should take a prominent position in approval of building construction. New concepts of integrating design featuring sustainable methods of generation and use of energy have to be developed, bringing together the mandates of environmental responsibility (Strategies of Mitigation of human impacts) , with the notion of climate responsiveness(strategies of Adaptation to Climate change).

To effectively mitigate long term impacts and adapt in the short term to inevitable climate alterations, the challenge is thus to identify and effectively put in place the design methodologies by which sustainable strategies can be integrated with current building models in order to guarantee the continuous social and economic growth of human developments, whilst limiting emissions and effectively responding to the consequences of climate alterations which are on the increase.

Also the Federal Government would have to make moves in strengthening

1. The existing institutional frameworks i.e. the Special Climate Change Unit (SCCU); to ensure effective coordination of climate change activities/programmes.
2. Development of a climate change policy to provide the basis for

articulation of national programmes and activities.

3. Provision of sustainable funding through budget allocation;
4. Provision of improved infrastructure for research, data collection and sharing. Improved human capacity development in all areas of climate change analyses.
5. Development of the framework for integration of climate change into national planning and development programmes.

The SCCU was created within the Federal Ministry of Environment in December 2006 to enhance climate and climate motioning system.

### Conclusions & Recommendations

Actions by individual African countries will not be adequate, rather it is essential to create a shared international vision of long-term goals, and to build the international frameworks that will help each country to play its part in meeting these common goals. Key elements of future international frameworks should include:- emissions trading; technological co-operation; action to reduce deforestation; and Adaptation.

Africa has a low level of expertise in climatic science and also lack observational climate data since most predictions are from international centres external to Africa, because the network of dilapidated weather stations could not provide valuable data on the continent's climate.

To this end, coordinated efforts for capacity building, training, research and development should be emphasized to provide for a continent – wide monitoring network.

African governments at the level of the African Union should negotiate at the international level and establish a joint high level Ambassador on Climate Change and Clean Energy. They should call on leaders of the industrialized countries who are largely responsible for climate change to support the continent to reduce its vulnerability and increase capacity to

adapt to climate change. They should also impress upon the leaders of the emerging economies to opt for a cleaner path to climate-friendly development, invest in renewable and use energy efficiently. The African government should of necessity prioritize climate change, raise awareness, prepare their countries for the necessary adaptation and allocate sufficient resources to this purpose of mitigation & adaptation.

Along with the unfolding apparently devastating phenomenon of climate change comes opportunities for Economic and Sustainable Development. These opportunities arise from the mechanisms provided in the Kyoto treaty. Among them in the Clean Development Mechanism (CDM).

This mechanism provides the opportunity for industrialized nations/industries to invest in projects in developing countries with the application of approved clean technologies and methodologies while meeting the country Sustainable Development indices. The potential additional GHG's abated during the lifetime of those projects are certified by the UNFCCC CDM and issued as Certified Emission Reductions (CERs) measured in tons of CO<sub>2</sub> called carbon credit. The carbon credits are traded / exchanged with resultant sustainable low carbon economic development and poverty alleviation benefits accruing to the country of domicile of the project while the investor benefits from lower GHG abatement costs

- African governments must prepare to speak strongly with one voice on climate change negotiations during the UN Summit on climate change in Copenhagen in December.
- Certainly there are still gaps in currently available knowledge regarding some aspects of mitigation and adaptation of climate change, especially in developing countries.

Additional research addressing those gaps would further reduce uncertainties and facilitate decision-making towards solutions to climate change problems.

- The optimal strategy to deal with climate change entails the adoption of both adaptation and mitigation measures
- In a recent UNEP survey nearly 90% of young people across the globe said they urge the world leaders to do "whatever it takes" to tackle climate change. Meanwhile, 40 percent of respondents to the 2008 climate confidence monitor survey- carried out in the lead up to the Pozan climate meeting- said they were more concerned about global warming than the global economy.

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