THE CHALLENGES OF TECHNICAL AND VOCATIONAL EDUCATION IN MITIGATING CLIMATE CHANGE INDUCED CATASTROPHES IN NIGERIA

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Abstract
This article focuses on the challenges of technical and vocational education in mitigating climate change induced catastrophes in Nigeria. The concepts of climate change and related areas were discussed in the paper including the causes and effects of climate, as well as, issues of prevention, preparation and adaptation processes. The roles that technical and vocational education may play in preparing citizens to prevent, adapt and mitigate the effects of climate change are presented. These include technical assistance; conducting research with a view to improve the quality of predictions of future changes to regional and environmental conditions; and changing the attitudes of citizens through education and public enlightenment to achieve a balance between ethics and the management of the environment. In light of these issues, the authors view technical and vocational education as an effective and significant tool in ameliorating the effects of climate change. It is recommended that technical and vocational education practitioners use their understanding of science and technology to deal with challenges posed by climate change in Nigeria.

Introduction

The threat posed by climate change is a global problem. It is a topical issue, generating heated debate and concerns among governments, scientists, environmentalists, and advocates of a better society. Indeed, the controversy trailing the debate all over the world is mind boggling and perplexing. For instance, the 2009 Copenhagen Climate Conference on climate change was inconclusive due to disagreements on funding commitments by governments. Whereas the developed countries are at least coming to an agreement on how to confront the challenges posed by climate change and how the effects can be mitigated, countries like Nigeria are having differing perspectives on what really constitute climate change and whether its threat is worth investigating. Not long ago the issue of economic meltdown swept across the globe with some experts claiming that Nigeria was immune to the shock of such financial crises. It is important to note that the complexity of this contemporary world is being shaped by the challenges of globalization and Nigeria can no longer afford to be complacent.

The United Nations, of which Nigeria is a member, with other international organizations as partners, are in the forefront to make the world a better place for habitation through several innovative and encompassing projects. One such example is the Climate Change Knowledge Network (CCKN), a project that tracks the impact of economic change and climate on India's agricultural sector. This is pursued jointly by the International Institute for Sustainable Development (IISD), the Center for International Climate and Environmental Research (CICERO) and the Tata Energy Research Institute (TERI). According to O'Brien and Leichenko (2000), the project is innovative because it uses the concept of "double exposure" which refers to the fact that climate change and globalization are occurring simultaneously, and that regions, sectors, ecosystems and social groups are often confronted by the impact of both processes.

However, in the context of related national issues, overcoming climate change and the adverse conditions that it may precipitate have the inclination to be fractured by many ills tormenting Nigeria today, such as poor planning and implementation, inadequate resource allocation, corruption, outdated curriculum, and poor governance practices.

Technical and vocational education is an inescapable component of the intellectual capital required for any meaningful effort aimed at tackling the climate change issue and its associated problems. Technical and vocational education, if properly positioned, can provide tools which will support Nigeria in strengthening knowledge, skills, attitudes and the capacity for adaptation to a changing and vulnerable physical environment. Nigeria is currently faced with increasingly chronic degradation of natural resources, greater prevalence and severity of natural and man-made disasters, such as desertification, oil spillage, flooding, internal social conflicts, and the potential displacement of persons. In this context, this article focuses on the role of technical and vocational education in mitigating the effects of global warming, including conceptual issues, causes and effects of climate change, prevention and preparation, and adaptation to climate change.

Concept Clarification, Definitions, and Issues

Global climate change is a term that refers to the exploration of both the question of whether the climate of the entire planet might be changing and why, and what the impact of those changes might have on investments in companies that may be affected by global changes in climate (Wikinvest, 2010). "The United Nations Framework Convention on Climate Change" (1997)

indicated that climate change is the change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Global environmental change encompasses many issues. According to the Intergovernmental Panel on Climate Change (IPCC) (2000), climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or land use. Sometime in the middle of the 20th century the first increase in the earth's temperature was observed. Since then global warming has become a major worry for humanity. Many scientists are predicting that global warming could result in powerful storms, crop failures, rising sea levels, and volcanic eruptions in the foreseeable future. These apocalyptic predictions are becoming common knowledge.

As a result of the impact of climate change on nations and communities, vulnerability, adaptation and prevention issues are germane to this study. Similarly, IPCC (2001, p.2) defines vulnerability as "the extent to which climate change may damage or harm a system's sensitivity, but also on its ability to adapt to new climate conditions." Furthermore, in the IPCC (2000) report, vulnerability was defined as:

> The extent to which a natural or a social system is susceptible to sustaining damage from climate change, and is a function of the magnitude of climate change, the sensitivity of the system to changes in climate and the ability to adapt the system to changes in climate. Hence, a highly vulnerable system is one that is highly sensitive to modest changes in climate and one for which the ability to adapt is severely constrained (p. 3).

Adaptations to climate is the process through which people reduce the adverse effects of climate on their health and well being, and take advantage of the opportunities that their climatic environment provides (Smith, Burton, Klein, & Wandel, 2000). Furthermore, they explained that adaptation to climate change includes all adjustments in behavior or economic structures that reduce the vulnerability of society to changes in the climate system.

The climate zones can be separated into four, to include: dry lands and desertification, rainforest, highlands, and the flood plains. It is estimated that half the earth's surface of about 6.45 billion hectares is composed of dry lands. The dry lands are comprised of arid, semi-arid and dry sub-humid areas which are very prone to desertification. Climate factors such as rain, temperature, wind, and evaporation cause aridity of the soil, while soil degradation is human induced. Good examples of human induced soil degradation are tree felling, pollution, and overgrazing which cause desertification. On the other end of the continuum, the tropical rainforest is usually hot and humid. This area witnesses 10-11 months of rain yearly, falling mostly in the afternoons. The rainforest is very important because it is a major source of the earth's oxygen through the abundant and diverse plants it supports. Another benefit of these plants is their use as drugs to fight disease and illness.

The highland climate zones according to Wikinvest (2010) are mountainous areas. Their altitude help is a determinant to their climate and weather. Generally, the average temperature of each month is about 5-6^{o}C for each 1000 meters of elevation above sea-level. Days are generally warm due to solar irradiation and during nights temperatures drop to very low levels. Plants and trees are small and are adapted to withstand sub-zero conditions. Finally, the fourth climate zone

is the flood plains. These are areas of land over which a river or sea water flows or is stored in times of flood. As a result of heavy and consistent rain the land is unable to absorb it and flooding occurs which may cause rivers to overflow their banks. This happens with rivers across Nigeria.

The concept "Technical and Vocational Education" according to the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2001) is a comprehensive term referring to those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. According to UNESCO's document, "Revised Recommendation concerning Technical and Vocational Education," Technical and Vocational Education is further understood to be:

a. An integral part of general education;
b. A means of preparing for occupational fields and for effective participation in the world of work;
c. An aspect of lifelong learning and a preparation for a responsive citizenship;
d. An instrument for promoting environmentally sound sustainable development;
e. A method of facilitating poverty alleviation (p. 1-2).

Causes and Effects of Climate Change

According to Wikinvest (2010), since the industrial revolution, average global temperature has risen by one degree Fahrenheit. Accordingly, the causes of climate change are the increased intensity of solar energy or the cyclicality of earth's temperatures, volcanism, oceanic circulation cycles, biosphere impact, ultraviolet radiation variability, reflectivity, rotational variation, solar systemic change, galaxy position variability, and human influence. The impact of change in the level of carbon dioxide in the atmosphere as a result of burning of fossil fuels like coal, oil, gas and other green house emissions are the reasons that the globe is steadily warming even if it is seemingly slow. There are a number of other human induced climate changes that can be categorized under the following headings of pollution, desertification flood.

The consequential effects of this continued accelerated climate change as predicted by scientists are listed below:

- Melting polar ice caps will cause rising sea levels and coastal flooding, melting glaciers and warmer temperatures in mountain regions will lead to decreased snow melts, intensifying water scarcity.
- The influx of cold water from the poles will interact with warming ocean water to cause oceanic temperature fluctuations across the globe, possibly causing global ecological damage as sensitive keystone organisms (plankton, for example) die in their new environments, leading to organism that are higher in the food chain (tuna, for example) increasing in scarcity.
- Warmer air and water would cause more powerful hurricanes as it allows more water to evaporate and creates faster winds, making hurricane season more dangerous.
- Rapidly changing ocean salinity from polar fresh water could interact with the temperature fluctuations in the ocean to disrupt or even shift the Gulf Stream, an underwater current that is responsible for modern climate conditions.

The Nigerian economy is vulnerable to damages caused by these upheavals. The negative impact of global change particularly in the insurance industry could be monumental. Insurance companies stand to lose in the case of damages caused by powerful natural disasters by bearing the brunt of the cost of reconstruction. Agricultural companies and those reliant on agriculture would be affected by reduction in food production and rise in production costs. Increasing water scarcity occasioned by severe weather changes, i.e., melting glaciers and declining winter precipitation, could impact negatively on the industries that use water as inputs. Such companies that must contend with the rising cost of water include steel, paper, iron, petroleum, textile and chemical companies. Also contemplated is the vulnerability of the population to a potential scarcity of potable water. The clamor to turn away from energy that releases greenhouse gases will mean less use of coal powered production and gas powered vehicles. Thus, demands will decrease and prices of oil and coal will fall thereby lowering the income of Nigeria that is dependent on oil exports.

Technical and Vocational Education Objectives and the Climate Change Challenge

The intellectual framework of this section is built on revealing the objectives of technical and vocational education and creating a prism from which to view those objectives that could impact the challenges of climate change in Nigeria. In November 2001, UNESCO adopted a recommendation concerning technical and vocational education. The document directed member states, including Nigeria, to take whatever legislative or other steps necessary to give effect to the principles set forth in their recommendation.

These ambitious goals set by UNESCO and the international community, together with regulatory bodies and academic institutions, were aimed at ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life skills programs. The various technical and vocational education curricula of tertiary institutions in Nigeria approximate that of UNESCO's principles and are updated frequently. The objectives of technical and vocational education were clearly conceived by the planners and stated very expressly to show the direction of change envisioned for all countries of the world. The document specifies in concrete terms how to create open and flexible educational structures to cater for upward mobility in learning and work. It also abolishes barriers between levels and areas of education, education and the world of work, and between school and society. In particular, Section 5 (b) (UNESCO, 2001, p. 2) is noteworthy. It envisages the objectives to, "lead to an understanding of the scientific and technological aspects of contemporary civilization in such a way that people comprehend their environment and are capable of acting upon it while taking a critical view of the social, political and environmental implications of scientific and technological change." The implication therefore is that technical and vocational education through these objectives is given the necessary empowerment and mandate to provide quality technical and vocational education and training to effectively help students and workers develop their knowledge in science and technology across occupational areas including those that address climate change related challenges.

The rest of this article is dedicated to exposing the various climate change issues that technical and vocational education may impact. Those issues are as follows:

- Prevention, preparation and adaptation;
- Supporting governments, schools and communities;
- Technical assistance;

- Research programs;
- Changing attitudes and ethics;
- Vulnerable populations in Nigeria.

Prevention, Preparation, and Adaptation

Though scientists agree that some of the effects of climate change can no longer be stopped, they believe that the process may be harnessed or slowed by stopping global warming. The way towards this goal is to halt the release of carbon dioxide into the atmosphere. According to Meludu (2010) the most industrialized African countries, such as South Africa, generate 8.44 metric tons of the greenhouse gas carbon dioxide per person, and the least developed countries, such as Mali, generate less than a tenth of a metric ton of greenhouse gas carbon dioxide per person. There is no doubt that technical and vocational education is an integral part of science and also a partner in the global education for all initiatives. Technical and vocational education is therefore, a tool that can be used in partnership with other agencies to prevent climate change where possible or prepare citizens to adapt to climate change. The professionals in technical and vocational education are directly involved through effective participation in environmental and climate change induced sectors as forestry, fishery, oil and gas, and mining. Technical and vocational education can be employed to increase clean energy jobs and to provide professional services in the maintenance of machines, appliances, and vehicles so that reduction in greenhouse gas emissions are achieved.

Technical and vocational education practitioners could play a vital role in public education and citizen engagement to prepare it for climate changes, so that people may adapt to the changes that cannot be avoided. Areas that need the services of technical and vocational education workers are education and information on good eating habit, i.e. avoiding pre-packaged foods, soft drinks, and fast foods. Apart from dietary issues of high content of fat, sugar, and calories, resource materials and energy are depleted in producing the packaging for these foods. Secondly, people could be advised to travel differently, i.e. walking and riding bicycles to reduce the use of cars and buses that use gasoline. Thirdly, practitioners could be involved in creating awareness for a "green" culture.

Supporting Governments, Schools, and Communities through an Inclusive Curriculum

Technical and Vocational Education practitioners can play a major role in supporting governments, schools and communities through building capacity for the promotion of environmentally sustainable programs. Such programs will increase public understanding of the interdependence between their environment, their community and country, and their lives. A child-based, facility-based, and skills-based curriculum could be designed by technical and vocational education experts to empower students' preparedness in natural disaster risk reduction techniques. Other ways that technical and vocational education content may be integrated are:

- Promotion of specific disciplines, for example, ensuring a skilled and educated workforce in taxonomy and systems, who can competently document the changes and patterns in biodiversity.
- Integrating timely communications, including awareness concerning projects and developments in every area of climate change.

- Including environmental and climate change issues as prominent topics in school curriculums to benefit their communities.
- Establish interdisciplinary studies with technical and vocational education experts who can partner to benefit from methods, background, and overall experiences of professionals in their various fields of specialization.
- Advisory role, as a discipline technical and vocational education, has the capacity to make valuable impact as advisors to improve the services of government agencies like the Nigeria Environmental Standards Regulation and Enforcement Agency.

Technical Assistance

Technical and vocational education professionals are well equipped to provide technical assistance to consumers, businesses, and home owners to enable them to make choices that will assist in reducing green house gas emissions. Specific areas that need technical advice include, consumer purchasing decisions, transportation options, the of refrigerators and air conditioners with programmable thermostats and avoiding the purchase of second-hand refrigerators and air conditioners, the use of smart meters, the use of energy saving lighting options, and the use of solar energy options.

Research Programs

The scientific community has embarked on multi-disciplinary projects in global change research. According to McBean and McCarthy (2007), programs have emerged to answer questions of global significance aimed at reducing scientific uncertainties and improving the quality of predictions of future changes to global and regional environmental conditions, thereby ensuring better management of the earth's ecological resources. Technical and vocational education professionals can be partners in this effort. It is important to collaborate in research so that governments and agencies in Nigeria do not waste resources through the development of incompatible actions or through ineffective policy and development plans that are not effective in achieving climatically sustainable development.

Changing Attitudes and Ethics

Humankind is part of nature. Many planning decisions on how to integrate human activities into the environment for the purposes of culture and aesthetic values need to be clearly understood. The planning of houses in our cities, building of parks, forest maintenance, farming systems, all are processes that should be influenced by ethics. How forests are managed depends on how furniture workers go about their work and the same can be said of agricultural workers. Technical and vocational education professionals can change the attitudes of people through education programs so that a balance between ethics and management of the environment may be achieved.

Vulnerable People and Places in Nigeria

According to Watson, Zinyoera, and Moss (2007), Africa is the continent most vulnerable to the impacts of projected changes because widespread poverty limits adaptation capabilities. For example, Nigeria, particularly the farming sector, relies on the quality of rains during the rainy season. Thus food security is an important issue as climate change increases the incidence of drought and represents a very serious threat. According to Downing, Ringius, Hulme, and

Waughray (2007), in Africa drought hazard and vulnerability are likely to be the most damaging locus of impacts of climate change. In Nigeria, people living in arid or semi-arid areas, coastal areas that are flood-prone, and oil producing states face more challenges and need the services of technical and vocational education professionals to enable them adapt to their environment.

Conclusion and Recommendations

The havoc caused by climate change induced catastrophes all over the world has the potential to change the progress of nations and foreclose the hope of future generations for a better life. When we hear about hurricanes like Katrina; earthquakes in Italy, Japan, Haiti, and China; tsunamis in Japan and Southeast Asia; and oil spillages in the Gulf of Mexico; we are quick to count our blessings and proclaim that such disasters are not our fate. But now we have devastating erosion menaces across Nigeria with desertification in the north, dumping of toxic waste in Koko, oil spillage and floods in the south, lead gas poisoning in Nasarawa. This may just be just the beginning. How prepared are Nigeria's emergency response related agencies and, in fact, the technical and vocational education professionals? Technical and vocational education professionals, as part of the scientific and technological community, are well positioned to tackle the challenges of climate change.

Arising from this study, the following recommendations are presented:

1. Technical and vocational education practitioners should use their understanding of science and technology to deal with challenges posed by climate change.
2. Governments (national, state, and local) should be assisted by technical and vocational education professionals to make the required legislation that will give effect to the principles set forth by UNESCO.
3. Technical and vocational education curricula should be reviewed and revised continually to ensure that students are empowered in natural disaster risk reduction techniques.
4. Continued research aimed at improving predictions of future climate changes should be pursued by technical and vocational education professionals**.**

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