

The Role of the Environmental Engineers in Environmental Sustainability

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Abstract

Environmental degradation has been caused by human activities in order to achieve his developmental needs. This paper examines the role of professionals and professional organizations in environmental sustainability; with specific attention to the role of the environmental engineers in environmental sustainability. Examination of environmental engineering and the environmental engineer was made; some human activities and their consequences on the environment which lead to environmental unsustainability were explained. Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The environmental engineer remains the vehicle to bring about environmental sustainability by some of the following ways; devising and promoting concepts of eco-design and resource efficiency, delivering solutions for corporate and regional sustainability and low carbon economy; improving ways of assessing and treating contamination at polluted sites; devising recycling systems and developing uses for recycled materials, and reducing the volumes of solid and hazardous waste through conservation.

Keywords: sustainable development, environmental, environmental engineering, eco-design and pollution

1. Introduction

Man cannot do without development. Development especially industrial and/or infrastructural developments have affected the environment. The environment in most cases has been devastated. From history's point of view, it noticed that man have repeatedly caused environmental disasters (Pawlowski, 2010). This action calls for environmental sustainability

addresses the ability of society to maintain and improve quality of life (development) while preserving both the quality and availability of its natural resources (EESS, 2018).

In order to address the environmental challenges and to attain environmental sustainability, then evolve environmental engineering. Environmental engineering is the branch of engineering that is concerned with

protecting people from the effects of adverse environmental effects, such as pollution, as well as improving environmental quality (USEPA).

Environmental engineers play major role in environmental sustainability. They use the principles of engineering, soil science, biology and chemistry to develop solutions to environmental problems (Occupational Outlook, 2016). They are involved in efforts to improve recycling, waste disposal, public health, and water, and air pollution control; all in attempt to restore the environment back to its original state (USEPA).

1.1 The Definition of Environmental Engineering and the Environmental Engineer

Peavy *et al* (1985) defined environmental engineering as that branch of engineering that is concerned with protecting the environment from potentially deleterious effects of human activity, protecting human populations from the effects of adverse environmental factors and improving environmental quality for human health and well-being.

Environmental Engineering is the application of science and engineering principles to improve the environment (air, water and/or land resources) to provide healthful water, air and land for human habitation and for other organisms, and to remediate polluted sites. Environmental engineering is closely associated with other branches of engineering, e.g., Civil and Chemical, and with the sciences of Chemistry, Physics and Biology. In addition, Environmental Engineering is associated with subsets of the above, e.g., Hydrology, Meteorology and Atmospheric science as subsets of Physical Science, Water, Air and Soil Chemistry as a subset of chemical science; microbiology and ecology as a subset of biological science (Kiely, 1998). Environmental Engineering may seem like “all things for all men.”

The practice of environmental engineering dates back to the dawn of civilization. Ever since groups of people began living in semi-permanent settlements, they have had to deal with the challenges of providing clean water and disposing of solid waste and sewage. With the growth of cities and the advent of large scale farming and manufacturing, people have also had to worry about air quality and soil contamination. Environmental engineering today addresses problems in the water, air and

soil environments.

1.2 Who Is an Environmental Engineer?

An Environmental Engineer is one who acquired the knowledge of Engineering to solve environmental problems. According to U.S Occupational Outlook (2016), Environmental Engineers use the principles of engineering, Soil Science, Biology and Chemistry to develop solutions to environmental problems. They are involved in efforts to improve recycling, waste disposal, public health, and water, and air pollution control. Environmental Engineers work in a variety of settings because of the nature of the tasks they do.

1.3 Some Human Activities and Their Consequences on the Environment

Fundamentally, it is the human civilization that has changed some of the crucial relationships among the world's species on the one hand and between those species and their inhabitants on the other hand. In effect, the environment that inhabits all things has become increasingly tenuous, and this in turn has begun to threaten the quality of life, both for human and non-human, on the earth. This way of living “civilization” especially in the last three centuries did not give any regard to the original delicate balance that existed among the inhabitants of the earth. This is the heart of unsustainable development that threatens and undermines the integrity of fundamental life-support systems namely; the air we breathe, the water we drink, the food we eat, and the divers fabric of living things that provides emotional and spiritual sustenance as well according to David and Webel (2002). It is important to note that it is not all aspects negative and stands condemned.

Human activities, mainly associated with the burning of fossil fuel, have changed the chemistry of the atmosphere. Carbon dioxide is produced primarily when fossil fuels are burned to provide energy for expanding industrial society and is the guiltiest of the green-house gases in respect of the global warning (Radford, 1998). The global atmospheric concentration of carbon dioxide gas increased from preindustrial value of about 280 ppm to 379 ppm in 2005, while preindustrial value of methane was 715 ppb has increased to 1774 ppb in 2005. The atmospheric concentration of Nitrous oxide (Nox) escalated from pre-industrial value of about 270ppb to 319 ppb in 2005 (Simonis, 2007).

As the volume of so called green-house gases including: CO₂, CO, CH₄NO_x, and CFC increases, the temperature close to the earth's surface rise gradually resulting to global warming. Many of the seas have been seriously degraded in recent years according to Medonagh (1999) and so many oceans.

Human activities have led to other manifestations of environmental degradation creating pollution of various types, wastes (toxic, industrial, domestic, solid), acid rain, desertification, deforestation, ozone layer depletion and erosion (Oyeshola, 1998; Adinna 2001).

Desertification is the major all season environmental menace troubling most states in Northern Nigeria where more than 90 percent of the citizens rely on fuel wood. The grazing by the animals of the vegetation is another activity that leads to desertification. Erosion is another environmental problem in Nigeria (Tell, 1 October, 2007).

Flooding is another environmental problem that occur throughout the country in three main forms. Deforestation has become a major environmental problem in Nigeria. This is due to hardwood logging and outrageous population growth being experienced in the country. Construction of developmental projects, their implementation and related activities leading to industries, air ports, recreational places, park, mechanized farming, housing estates, and so on also contribute to deforestation because they take and occupy space (Oyeshola, 2008).

The problem of industrial pollution is unquantifiable: It is a serious problem in Nigeria according to the News (February 12, 2000).

In-appropriate agricultural practices, petroleum prospecting with its attendant oil pollution problems and gas flaring are some of the causes of land degradation in Nigeria.

Generation and disposal of domestic and industrial waste is a problem in Nigeria. Some of the industrial wastes are often dumped on the ground, thrown into the stream flakes or disposed of in a deep hole in the ground. The ultimate sufferer of these methods of disposal is the physical environment (Tell, October 1, 2007). Observing the growing numbers of species pushed to extinction, growing numbers of people feel a sense of foreboding for the human future (Barash & Webel, 2002).

Many environmentalists see the connection between despoiled, depleted and polluted lands and human misery. Many environmental experts fear that we cannot continue on our present much longer without causing irreversible damage. Environmental degradation, on the long run, translates directly not only into less interesting and less beautiful planet earth-one deprived of wildlife, for example, or scenic values — but it also means thirst, hunger, poverty, sickness and misery for unacceptable number of humanity (Oyeshola, 1995, 2008).

In all, negative human activities and their consequences on the environment are intricately connected and are complex. This is because they manifest in unsustainable development practices that endanger the very base upon which the human existence depends. Therefore, it must be recognized that the issue of unsustainable development showing in negative human activities that are affecting the environment is big and complex in its manifestation. They need to be addressed through sustainable development.

2. What Is Sustainable Development?

The Rio de Janeiro conference of 1992 and the Johannesburg 2002, 'Earth summit' promote strategies to fully integrate the relationship between the environment and development. The initiative is a testimony to the currency of sustainable development in global polity. The issue of sustainable development is now seen as the problem that is confronting humanity (Oyeshola, 2008). What then is sustainable development?

Many scholars have defined the concept sustainable development from different perspectives.

World Commission on Environment and Development (WCED) defines sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). Sharachchandra Lele describes sustainable development as "A new way of life and approach to social and economic activities for all societies, rich and poor which is compatible with the preservation of the environment" (Lele, 1991). But according to Pearce and Watford (1993), sustainable development describes a process in which the natural resource base is not allowed to deteriorate. It emphasizes the hitherto

unappreciated role of the environmental quality and environmental inputs in the process of raising real income and quality life.

Sustainable development implies three primary factors of economic, social and environment. Environmentally sustainable system must maintain a stable resource base, avoiding over exploitation of renewable resources systems or environmental sink functions and depleting non-renewable resources only to the extent that investment is made in adequate substitutes. This includes maintenance of biodiversity, atmospheric stability and other ecosystem function not ordinarily classified as economic resources (Oyeshola, 2008).

The natural environmental constraint to development is the main reason for any concern about sustainability. More precisely, the economic processes of production and consumption draw to a greater or lesser extent on services provided by resources of the natural-physical environment. These resources are of two broad types: natural resources and environmental resources (Sundar, 2006).

Natural resources of the conventional type-recognized by economists as crucial inputs to most production processes include non-renewable such as minerals, renewable such as forests, and all form of energy. On the other hand, environmental resources provide services not only for immediate human consumption but also for use in connection with production as well as consumption processes. The former services sustain the biological bases of human life as well as provide enjoyment of natural resources by people. The latter services derive mainly from the absorptive capacity of the physical environment and as such contribute to human well-being.

3. The Role of the Environmental Engineer in Environmental Sustainability

As the world's population increases, engineers face ever-evolving challenges with regard to issues of sustainability and the health of our natural environment. (EESS, 2016). According to Pawlowski (2010), introduction of sustainable development is associated with using the knowledge from the fields of both social and technical sciences. Within the second group, an important position is occupied by environmental engineering.

Pawlowski (2007) defined Environmental engineering as a discipline in the field of

technical science, utilizing engineering method:

- (i) For preserving, rational shaping and using external natural environment (e.g., water resources, waste management, air protection and soil protection).
- (ii) For preserving and shaping internal environment of rooms and constructions (devices and installations).

Environmental engineering realizes a wide variety of pro-ecologic activities within the fields described:

- (i) Shapes appropriate conditions and technological methods to uphold proper parameters regarding the human environment.
- (ii) Shapes appropriate technical conditions and technological methods to secure the environment's natural biological balance.
- (iii) Limits adverse effects of mankind's economic activity through appropriate designs.
- (iv) Provides technology allowing to reduce the usage of non-renewable resources including: cleaner production, recycling raw materials from wastes.
- (v) Mitigates the effects of natural disasters namely: Floods, droughts, pollution in air, water and soil.

This definition shows how significant environmental engineering is for realization of the sustainable development concept. It shapes the conditions of human life, it touches upon the issue of resources, which in turn determines meeting human material needs, both for the present generation and in the future.

Also, environmental engineering is connected with new technical approaches to the environment known as:

- (i) Industrial ecology — which aim is to adapt an understanding of the natural system and apply it to the design of the man-made system (Frosch, 1989).
- (ii) Green Chemistry also known as green engineering (Garcia-Serna et al, 2001), (USEPA) which is about the design of chemical products and processes that reduces or eliminate the use and generation of hazardous substances (Lean & Hinrichsen, 1994).

Among detailed problems, energy issues must be addressed: energy supply, preserving energy carriers and, especially, the use of fossil fuels which need to be replaced with biofuels.

An environmental engineer with focus on sustainability will

- (i) Apply his expert knowledge in sustainability assessment methods and tools to undertake life cycle assessments, material flow analyses or environmental footprint studies of projects, processes or products.
- (ii) Work in a team to develop environmental policies or management plans for a company or a government authority.
- (iii) Find solutions for problems that matter such as climate change, water availability, energy futures, waste management or low-carbon living.
- (iv) Advise on and contribute to environmental and sustainability frameworks for corporate and regional sustainable development.

Environmental engineers with specialization in sustainability might work directly for multinational organizations, such as the United Nations, in government departments or in large companies. They might also work part of a private consulting company providing services to the water, infrastructure, manufacturing, natural resources and environment sectors. These environmental engineers develop projects that monitor the impacts of climate change on infrastructure and look at ways to reduce those impacts, or they might take a national approach to implementing recycled water schemes, or an international approach to better environmental management for sustainable development.

4. Conclusion

Man cannot live without the environment. Despite this established fact, the relation between man and the environment is far from peaceful co-existence. Human developmental efforts have done more harm than good to the environment.

There is the need to balance human development with environmental sustainability. Sustainable development is perhaps the most important idea of or present time. This concept anticipates major civilizational change on the ecological, social and economic level. To make this happen, we need not only the knowledge

given by the social sciences, but also technical knowledge. This is the aim of environmental engineering, which is shaping the human environment.

The environmental engineer remains the vehicle to bring about environmental sustainability by some of the following ways:

- devising and promoting concepts of eco-design and resources efficiency;
- delivering solutions for corporate and regional sustainability and low carbon economy;
- improving ways of assessing and treating contamination at polluted sites;
- devising recycling systems and developing uses for recycled materials; and
- reducing the volumes of solid and hazardous waste through conservation and reuse.

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