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REVIEW OF CONTEMPORARY SOCIETAL CHALLENGES AFFECTING ENVIRONMENT FACED BY ENGINEERS

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ABTRACT

Society is defined as a group of people living as a community or an organized group of people for a common purpose, a group of people who meet from time to engage in a common interest, a group of animals or plant living together in a single environment, constituting a homogenized unit or entity, its long - standing group of people sharing cultural aspects such as language, dress, norms, behavior and artistic forms. The high increase of the population brings about societal challenges that affect the wellbeing of the masses (human) and the plants. The high rate of environmental degradation, lack of portable drinking water, failure of infrastructures and depletion of energy among others issues is a major course of concern for engineers to intervene for better living standard of the population. This paper reviewed that natural source of energy such as oil and gas sector are highly diminishing without replacement, Nigeria as a developing country needs renewable energy as an alternative. This paper also highlights the challenges of

inadequate drinking and domestic water and its consequences as it affects the society. Finally, the paper point out how natural environment must be preserved through engineers adhering to good engineering principles, good decision makers and good policies.

Keyword: ***Society, Challenges, Water, Infrastructure, Energy and Engineers.***

INTRODUCTION

Engineering has been defined as that Art of Science that harnesses the resources of nature to produce and maintain an artifact for the benefit and convenience of mankind. It is the practice of designing machines, bridges, railways, electrification of cities, communication equipment, petrochemical industries, infrastructures etc. In short, it is the application of science to solve societal problems.

The Oxford Advanced Learner's Dictionary defines profession as "a type of job that needs special training or skill, especially one that needs a high level of education". There are a number of characteristics which distinguished a profession from other less formally constituted trades and occupations. The professional discipline has a command of a specialized body of knowledge necessary for planning, design, construction and operation of physical structures or engines/machines. The body of knowledge is transmitted through recognized training and regularly updated on behalf of the professional body to ensure certified standards of proficiency. A code of Ethics and standards govern the practice of the profession and ensure the satisfaction and safety of the client in particular and the society in general. A monopoly is usually granted to a professional body by society through laws to ensure that only registered members can engage in the professional practice. The members are committed to constant educational renewal through a lifelong learning of latest technology and professional development.

The professional body is legally to regulate itself, discipline its members and control the practice of the profession. The engineering profession exists in every aspect of human endeavor cutting

across religious, socio-cultural, economic and political barriers; hence engineering is a way of life. Professionalism is about commitment to standards of excellence in the performance of tasks which require specialized skills and expertise. And professionalism thus refers to someone whose basic satisfaction is in performing well, task for which he has been trained and always strives to achieve the best standard possible in any circumstance. Thus, to be a professional is to flaunt the highest levels of the skills one professes to command. Engineering is the application of scientific and mathematical principles, experience, common sense and judgment to design, analysis as well as the operation of structures, machines and system. As indicated by Albert Einstein, "scientist investigate that which already exist, engineers create that which has never been" as define by the accredited board for engineering and technology (ABET) engineering is the profession in which knowledge of the mathematical and natural sciences gained by study, experience and practices applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind. Engineering in general is that profession that deals with the application of mathematical and scientific knowledge to improve infrastructures like bridges, dams, buildings, roads, railways and common utilities to help improve human lives and our society. These improvements are done while ensuring that infrastructure is safe, environmentally and economically. Engineers do not only have the social responsibility to properly maintain and adapt structures that we depend on in our daily life, they are also involve in making sure the infrastructures are adapted to meet natural disasters, population growth and climate change challenges. Various engineering fields are faced with different challenges in the environment, many out of which this article intend to discuss are, environment, water, infrastructure and energy. These challenges are the core variables that determine the development of any place in the country.

THE HISTORY OF ENGINEERING IN NIGERIA

The history of engineering in Nigeria traces its root to the establishment of the Public Works Department (P.W.D) of southern Government in Lagos in 1896, the P.W.D comprised mainly of three sections (Civil, Mechanical and Electrical). It was responsible for the management of engineering problems in the southern Government of Nigeria. As the country entered into independence in 1960, the three regions (North, East and West) had their separate P.W.D. In 1966, the Nigerian council for scientific and industrial Research (NCSIR) was established. The NSCIR gave rise to the establishment of: International Institute of Tropical Agriculture, Ibadan (IITA) in 1967, Kaduna polytechnic in 1968, Yaba College of Technology in 1969, and a new council called Nigerian Council for Science and Technology (NCST). The creation of the NCST engendered the promulgation of Nigerian Steel Development authority (NSDA) Decree of 1971. In the same year, the Agricultural Research Council of Nigeria (ARCN) was established. Also, in 1971 on the recommendation of NCST, the industrial Training Fund (ITF) was established. In 1973, the Petroleum Technology Development Fund was created to train Nigerians in the field of Engineering, Geology, Science and Management in the petroleum Industry. This lead to the establishment of the Petroleum Training Institute, Warri. The National Science and Technology Development Agency (NSTDA) was established in 1977 and in 1980, a separate Ministry of science and Technology was born. In compliance with Vienna (1979), directives and recommendations, apart from the existing specialized Federal Polytechnics, more Federal Universities of Technology were also established in 1980 to cater for the training of engineering manpower. In 1987, the National Science and Technology Fund (NSTF) were put in place to provide fund for activities in science and technology. In 1988, the Raw Materials Research and Development Council (RMRDC) were born for the development of industrial raw materials, creating self-sufficiency and maximization of inputs to local industries. Evidence of Engineering and Technology in Nigeria is seen in development and adaptation of appropriate machines and

equipment for easing out tedium and drudgery in certain operations in agriculture and Industries developed by these government and NGOs.

Environment is define as the surrounding or conditions in which a person, animal or plant lives or operates; the natural world as a whole or in a particular geographical area especially as affected by human activities. Environment means anything that surrounds us, it can be living (biotic) of non-living, a biotic things. It includes physical, chemical and other natural forces. Environment plays an important role in healthy living and the existence of life on planet earth. Environment is a home for different living species and we all are dependent on it for food, air, water and other needs. In the field of Engineering: Agricultural, civil, Marine, Mechanical, and Electrical, etc engineers are faced with various problems such as food shortage to meet the increasing population, failed and collapse buildings due to substandard products and incompetent personals that in turn costs lives and valuables that money cannot buy. With respect to these, the paper highlight the challenges faced in our contemporary society by engineers respectively.

A challenge is defined as the situation of being faced with something that needs great mental or physical effect in order to be done successfully.

ENVIRONMENT

Global warming otherwise known as climate change is coursed mostly by the impact of man-made emissions, been it from combustion engines and other fossils fuels consumptions and their impacts on meteorological changes that result to environmental hazard and disaster creating issues that call for immediate attention by engineers. The environment is a constant consideration in the lives of the people including the development of technologies and their associated impacts, addressing the environment is a topic of challenge as describe with respect to natural and man-made hazards. With advances in technology, the impacts can be monitored in order to provide

the necessary alerts, through this technological evolution also translates into greater implication for natural resources enquiring efficient technical solutions. The climate of our place is constantly changing due to natural courses, there is strong evidence that a significant contribution to current rates of changes in the globe is due to our growing consumption of fossils fuels and the resultants Co_2 emission. One of the major challenges is how to be able to predict and respond to consequential events and their impact on the environment/peoples live. Through the aid of remote sensing, monitoring of environmental parameters, it is possible to study their behaviors and evolution, enabling the necessary measures to minimize catastrophes, many parameters of strictly natural origins (geophysical) and others coursed by humanity contributes significantly or even have sole responsibility (radiation, pollution). Remote sensing network employed by engineers to monitor and give alarms of event happening will be of extremely helpful in areas of flood, fire, volcanic eruption and seismic among others. The society/environment is rapidly moving toward a disposable consumption economy that producer's large quantities of waste, a significant portion of these waste comes from the technological used (Plastics bottles and mobile phones) Punch paper of November 30, 2010 reported that indigenous mobile phones users, such as the iphone and blackberry are becoming indispensible to many mobile phone uses, many claims both real and imagined of people getting injured or some dying while using their mobile phones, amounting to additional challenges brought by civilization to the environmental that need to be addressed by engineers. Environmental pollution causes discomfort to the people living within and gives room for communicable disease of different type through chemical waste from herbicides (flood) and sewage from both farms and industries into water bodies killing water habitats and making water unfit for drinking and cooking. EIA, Environmental Impact Assessment and Sanitization to the users by engineers will go a long way in reducing the effect if properly conducted.

WATER:

Water is a universal resource which, because of its free occurrence in nature, is often taken for granted and abused, especially in third world nations where information is neither readily accessible, nor disseminated to society. Abundant as it may seem, water, in its clean state, is one of the rarest elements in the world (Omole and Longe, 2008). Water is derived from various sources such as the ocean water constituting 97% of the earth's water, ice 2%, and 1% fresh water obtained from the rivers, lakes, underground water, the atmospheric and soil moisture (Odey, 2009). The challenges of water supply have constituted a factor inducing conflicts in some parts of the world because the earth's fresh water is diminishing due to man's activities and climate change. Nigeria as a nation is in no way disassociated from the challenges of water supply.

When Samuel Taylor Coleridge wrote "water, water everywhere, and no any drop to drink" he did not have the 21st century's global water situation in mind. But allowing for poetic licenses, he was not far from correct. Today the availability of water for drinking and other uses is a critical problem in many societal areas of the world including Benue State where we have river Benue. Lack of clean water is responsible for more deaths in the world than war, about one out of every six people living today irrespective of the zone/society do not have adequate access to water, more than double that number lack basic sanitation for which water is needed that lead to epidemics such as Cholera, typhoid and other related sickness, in school environment, been it secondary or tertiary institution, ladies for lack of potable water supply find it difficult to attend classes/lectures when their monthly period commenced for about three (3) to four (4) days. In many countries, half the population does not have access to safe drinking water hence affliction with pool health, going by estimate, each day nearly 5,000 children worldwide die from water related diseases, a toll that would drop dramatically if sufficient water distribution measures for

sanitation is made available. Water sources and supplies are contaminated not only by the people discharging toxic contaminants but also by arsenic and other naturally occurring poisonous pollutants found in ground water aquifers. This has to do with getting the right coordination mechanism for sustainable drinking water supply and sanitation service delivery in the country. The responsibilities of provision of water supply and sanitation is rested on an engineer who can provide surveillance on where to dig a borehole for the entire society. The challenge therefore, is how to achieve a synergy and well-coordinated mechanism between engineers and government to deliver sustainable drinking water supply and sanitation services to the people of Nigeria. Other hindrance that kept Nigeria off track towards achieving water and sanitation include poor executive capacity and management, low investment in operation and maintenance, inadequate funding, poor national water resource management, and poor institutional framework (Olaseni and Alade, 2012). Moreover, other reasons for fluctuation in access to drinking water and sanitation coverage is basically due to inadequate institutional arrangement, lack of proper management of the nation's water resources, poor data collection, collation and archiving, poor community and private sector participation, epileptic power supply and inadequate awareness on issues of water conversation and management, weak management and executive capacity and low investment level in operation and maintenance by engineers. (Vision2020). For a healthy sustainable future for the population, developing methods of ensuring adequate water treatment and supplies is a great engineering challenge of the first magnitude.

INFRASTRUCTURE:

Infrastructure is the basic physical and organizational structures required for the proper running of a society that is, creating and establishing industries, buildings, health services, power supply, roads and railroads, telecommunications, etc. It is the enterprise or products, services and facilities necessary for an economy to function. Sullivan and Sheffrin, (2003). In the same vein,

Olufemi (2012) described infrastructure as generally a set of interconnected structural elements that provide framework supporting an entire structure of development. Infrastructure is the combination of fundamental systems that support a community/society, region or country; it includes everything from water and sewer systems, roads and rail networks, national power and natural gas grids. Basic infrastructural needs in the society are still problematic and engineers are challenged economically to provide such services more broadly a task. Infrastructure is made up of public utilities such as such as power, pipe born water supply, telecommunication, sanitation and sewage, solid waste collection and disposal, piped gas. While public works include roads, major damps, canal works for irrigation and drainage. More infrastructures are in the transport sector such as; urban and inter-urban railways, urban transports, water ways and airports, etc. The nature of infrastructure of any country is directly connected with the quality of life. "According to recent statistics, the living conditions of most people in Africa, appears to have either not improved or only done so insignificantly. This situation arises from the misrule\ of our early political leaders most of whom were instrumental to the struggle for independence" (Eregha, 2007). A study by McKinsey Global Institute (MGI) revealed that, Nigeria had the potential to become a major global economy over the past Fifteen years. MGI also estimated that in 2013 -2030 Nigeria could expand its economy more than 6% annually, with its GDP exceeding $1.6 Trillion going into the top global twenty economies of the world that is, if Nigerian leaders can work and ensure all inclusive growth, that thirty million people could escape poverty. The problem is, Nigeria depends too much on foreign aides and assistance which is limiting her prospects. (MGI, 2014).Due to lack of visionary leaders, there is poor attitude towards maintaining our critical infrastructures, thereby causing untold hardship amongst Nigerians. A major aspect where the country missed the mark is in the area of technological development of our educational sector. The importance of technology cannot be deemphasized as it makes learning more interesting and many more but just a few to mention. It helps to make

learning process more suitable and effective. Technological backwardness is traced to the colonial era when they discouraged our craftsmen and art men who where into artifact, blacksmiths and goldsmiths from constructing simple farm tools, firearms, etc. The reason the British government had to discourage our technological knowledge was basically economic reasons and not to encourage and develop us technologically, the colonial administration saw Nigeria as a ready market to market their finished goods. The truth is Nigerians were engaged both in industrial and practical art before the arrival of the whites, to the extent that even cast objects such as FESTAC Mask was stolen away from Lagos. As Akaniwor, (2008) noted, the colonialists discouraged further development of Nigeria technology for reasons that it was a threat to their potential market. He further noted that "Ogogoro" was termed as illicit gin by the colonial government and that whoever produced, market or consumes it was to be prosecuted, this was how technological advancement was discouraged and is still being discouraged. Infrastructure facilities are not demanded for their own sake, but for what they will help in producing. In all aspects, whether in developed or less developed societies, the capacity and capability necessary for business growth stem from the acquisition of science and technology, culture and the availability of enabling infrastructure. The enabling infrastructures are the major factors which must exist to allow private enterprises to operate and grow. Available infrastructure will make people to be creative, innovative, gainfully employed, self reliant, wealth creators and will ensure security. Therefore**, Structural Functional Analysis theory by Gabriel Almond** was implored to explain and justify that the problem of development crises in Nigeria which is mainly due to the structures and its functions in the country. This explains that for any society to function, it is largely dependent on the efficiency and effectiveness of its structures. Nigeria's developmental crises can be surmounted if she has selfless and vision-oriented leaders who can embark on reforms and policies that will maintain and sustain her country's infrastructure. Hence, having considered the essential nature of our infrastructures,

there is therefore the need for sustainable developmental efforts to reduce the harsh effect the infrastructure decay has caused the country. Sustainable development in this direction means improvement upon the needs of the people without compromising the ability of future generations to meet their demands. There is no doubt that available infrastructure will enhance creativity in the mind, innovations, gainful employment, to be self-reliant, create wealth and above all ensure reduction in crime and security issues.

What is involved in setting and maintain infrastructures? Setting and maintaining infrastructure is not a new thing. Engineers have been faced with the task to design a viable plan for setting structures and monitoring them. Without pointing at deteriorated roads that are found everywhere in the society, these affect not only the environment but the people that make up the environment, the social and economic state of the society, several roads are constructed but just for few months or years, they drastically starts peeling off creating pot holes impounding water, causing environmental pollution/hazards and threat of lives to road users.

This is caused due to inadequate compaction to meet up the bearing capacity of the weights that are running over, substandard materials used and personnel's lack of technical knowhow in handling such projects. Several structures are found collapsing every day across the world due to carelessness or negligence to SON as well as using substandard materials that cost less for selfish interest/gain which is more dangerous than any dreaded diseases if a total failure occur, single collapsing of a story building or a bridge claims or will claim thousands of lives unlike a medical personnel mistake on a patient that claim just a person's life.

ENERGY

As the planet earth continuous to evolve as a whole, the engineers as well as all innovators are facing serious domestic, societal and global challenges. All these challenges raised interest and intensive examinations in the aspect of energy among others, making solar energy and biogas

(renewable energy) an alternative over fossil fuels. Energy is mostly derived from electricity generated from hydro electric power stations with limitations in network distributions in difficult terrains and locations along with capital intensive. The natural fossil fuels are running out of reach, the oil and gas sector will not withstand the growing energy demands of the increasing population despite its environmental and health challenges**.** Nigeria has a population of 211,847,604 million based on projections of the latest United Nations data (July 1, 2021) and her population density is 226/km^2 (586 people per mi^2) of which 351,650 square miles (910,770 square km2) is the total land area. The total installed capacity in the grid as of December 2018 was 12,910.40 MW, while 2,143 MW is Renewable, of which 2,111 MW is Hydro power. The total exploitable potential of hydropower is estimated at over 14,120 MW, amounting to more than 50,800 GWh of electricity annually, over 40% of her population has no access to electricity. The demand for sustainable energy is rising globally. Thus, renewable energy has been identified as an absolute substitute for fossil fuels in a sustainable and environmentally-friendly way. Predominantly renewable energy is significantly a viable approach to sustainable development to both developed and developing nations. Nigeria over-dependent on delectable oil and gas while neglecting the never ending renewable energy is certainly unjustifiable.

Renewable energy is a solution to Nigeria's energy challenges. Aside from being sustainable and in exhaustible, it can be constructed in smaller units, hence, appropriate for rural community management and ownership, and could be crucial to economic development. Renewable energy is a vital element of sustainable development, is essential in reducing greenhouse gas emissions and creates a diversity of energy supply and security. Nigeria is endowed with rich renewable energy resources that can be used in generating electricity, the substantial ones being solar energy, small and large hydropower, biomass and wind. The Nigerian Electricity Regulatory

Commission (NERC) is committed to encouraging investment in renewable energy generation in Nigeria. With huge and mostly untapped potential in renewable energy resources, an obstacle to the development of renewable include the large oil and gas production in the South together with government fuel subsidies, the lack of clarity/market information on private sector opportunities, and a general knowledge gap concerning financial support mechanisms obtainable in the country. Renewable energy provides universal access to sustainable, reliable, affordable and modern-day energy, except for the traditional uses of biomass (e.g. for cooking) which is linked to major negative health impacts. To improve the present state of renewable energy resources in the country, the engineers and power sector should collaborate in solving the nation's power problems. This paper analyses the present state of major renewable energy resources in Nigeria such as solar, large hydro, small hydro, biomass (fuel wood, animal wastes, Agric residues and energy crops) and wind, with its present challenges and the benefits associated with the technology.

Tapping into the untapped renewable energy resources such as hydro, solar and wind will help in a long way to alleviating the power outage challenges confronting the nation. Also connecting These renewable energy resources to the grid will lead to economic growth which in turn will bring about job creation for the youths in the country. Literature reviewed that in 2005 alone global aviation produces 197 million metric tons of carbon emission. Fossils fuels cannot be relied on as the dominant sources of energy forever, it is now imperative for engineers to have an alternative via renewable energy (solar, biogas/biodiesel). As stated by the institute of heat engineering at the Warsaw University of Technology, solar energy and Biogas systems are the more environmentally friendly energy technology. The use of biodiesel is being encouraged by governments around the world as a way of reducing carbon emissions which are harmful to the environmental. Photovoltaic cell (PVC) technology which converts sunlight directly into electricity if bring to farmers understanding by engineers can be used for irrigation, water

development and lighting of farm dueling and livestock enterprises, business ventures, government parastatals, institutions, and many more will be powered through solar energy if engineers relentless sensitize and swing into installation. The task ahead for engineers with respect to solar energy as an alternative for fossil fuels will be a reality if adequate means is provided for solar energy storage, the storage of solar energy would create unlimited availability to the power source and effectively an uninterrupted cycle of energy that will meet the increasing demand of energy by the people. The challenges mentioned and discussed in this paper will only be minimized if team of engineers in all fields rise up with innovative ideas and professional experience against these challenges of environment, water, infrastructure and energy deficit by providing strong leadership with thoughtful ideas/ policy makers that will bring fruitful result. Engineers, your experience and expertise are needed, let all stand up to the tasks.

CONCLUSION

Engineering is a double-edged sword. It is both the cause of many environmental, social, economic and political problems faced by man and also a key to solving them. It is now recognized that engineers need considerable support in their attempts in various walk of life to promote sustainable development. There is no doubt that a lot has been achieved by the Nigerian engineers in this respect, but our unsatisfactory performance so far is a principal challenge for us to preserve the conditions for life and welfare of mankind, today and in the future. Even though our submissions here may not be all inclusive, it is our candid opinion that if the opinion given above is adhered to, and the engineer upholds the values of truth, honesty and trust-worthiness, human life will be safeguarded.

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