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Environmental Implications of Increased Industrialization in Nigeria

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Abstract:
In the last fifty years, Nigeria has witnessed an increase in industrial activities. Consequently, environmental hazards are alarmingly on the increase caused mainly by increased industrial activities taking place in major cities of the federation. This paper has examined the rationale for the increase and the deleterious effect arising there from. It has been stressed in the paper that though, industrialization meets the needs of the people by raising their standard of living and boosting the nation's social economic and political ego among the comity of nations, the activities are incongruous with the serenity of land, air and water which human beings, animals, plants and other activities depend. The paper has found that the huge industrial wastes being generated are affecting not only the living components of the environment but even non-living components like climate, water, air and structural assets. The paper has recommended ways in which such industrial activities should be pursued without causing harm to the environment: namely, recycling of wastes, strict monitoring of industrial activities by relevant authorities, insistence of government on the need for prospective industrialists to always prepare Environment Impact Assessment(EIA) document for scrutiny before granting them permission to operate as well as adequate public enlightenment on the dangers of industrial pollution in order to save the environment from destruction.

1. Introduction

The Federal Republic of Nigeria has an area of 923768 square kilometers and lies between latitudes4^0 and 14^0northof the Equator and longitudes 3^0 and 15^0 East of Greenwich Meridien (Omodanisi and Salami, 2011:668). It shares boundaries with the Republics of Benin and Niger in the West, Cameroun in the East, Niger and Chad in the North and the Gulf of Guinea in the South.

Although the country is entirely within the tropics, its climate varies from the tropical near the coast to the sub-tropical further inland. There are generally, two marked seasons namely: the rainy season which covers April to October; and dry season falls within November through March.

Geologically, half of the land mass is composed of three main basement complexes located in the West, the North-west and South-east. Between these massifs are sedimentary basins composed of recent deposits of clay, sand and gravel which stretch out along the north-east and south-west axis from Lake Chad to the Niger Delta along the length of the lower Niger- Benue River Systems while the North-west and South-east trenching Bida Basin follows the course of the upper Niger River (Omodanisi and Salami, 2011:669).

There are abundance of natural resources covering a land area of about 98.321 million hectares of which about 74.036million hectares are said to be cradle. A number of Nigerian scholars (Avav & Uza, 2002; Bida, 2002; and Ariyo, 2002) gave quantitative breakdown of some of Nigeria's natural resources as: 72 million hectares of cultivable land; 744,829 hectares. Of game reserves;2.35 million hectares of national parks;234.3 million goats; 30.5 million sheep;19.8 cattle; 3.9 million pigs; 1 million donkeys; 204000 horses; 18000 camels; 26 million poultry; and 12.5 million hectares of inland water mass capable of producing over 5 million metric tons of fish annually under proper management. It should be noted that the country is also blessed with wetlands, valuable forests, grassland areas, abundant sunshine and rain, enormous quantity of water with plenty aquatic animals and waterfalls for hydro-power generation.

The country's oil reserves amount is 25 billion barrels while gas reserves are reported to be about 256 trillion cubic feet (Ikporukpo, 2002:103). Similarly, National Bureau for Statistics report states that 44 solid minerals are found in commercial quantity and are spread across the 36 states of the country and the Federal Capital Territory, FCT Abuja (The Economy 2016:46). The population, as at 2006 was over 140 million people, comprising 50.78% males and 49.22% females (Atlas of Nigeria, 2011:31).

The above scenario shows that the country has a formidable base for industrialization. Therefore, the overriding objective of this paper is to examine critically the ways in which industrial activities are being encouraged by Nigerian government and the environmental problems arising there from with a view to recommending appropriate steps to take in order to safeguard the environment from degeneration.

The paper is organized into seven parts. Part **one** is the introduction; part **two** is the methodology and clarification of some key terms; part **three** is the theoretical framework; part **four** discusses the location patterns and trends in industrial development in Nigeria; part **five** discusses the ways in which the environment degenerates through industrial activities; part **six** examines the environmental implications of industrialization; part **seven** is the recommendation and conclusion.

2. Methodology of the Study and Clarification of Terms

The data for this article were obtained mainly from secondary source; although personal observation on the activities of some industries over the years gave some insight into the problem being discussed in the paper. Many environmental books and articles published in academic journals were read by the authors while preparing this paper. As a result, a lot of ideas and information derived from the secondary data were taken note of and expanded to meet the need of this paper the authors are grateful to all the sources of information obtained in preparing this paper.

Some words and terms frequently used in this paper requiring some clarification are industry, industrialization, pollution, environment and waste.

- Industry: This refers to an organized production or manufacturing of useful things from raw state by physical, chemical or both means being carried out at a factory site.
- Industrialization: This refers to the organized, systematic establishment, expansion and development of such factory based secondary economic activities like processing, oil refinery, bakeries and milling of primary agricultural products, smelting of tin, and iron among others.
- Pollution: The word was originally derived from Latin 'pollutioneum,' which means the introduction into the environment of substances, objects, materials or energy (SOME) greater than the environment land, air and water can cope, hence constituting a serious threat to man, animals, plants and the non-living elements. It simply means contamination.
- Environment: This refers to the surrounding space being occupied by man, animals and plants which supplies all organisms with the means of survival. All kinds of human activities are carried out in the environment.
- Waste: It refers to anything the owner no longer wants at given place and time having no current or perceived market value. Waste can be considered as pollutant which exists in any of the three states: solid, gaseous or liquid.

3. Theoretical Framework

Understanding why Nigerian government continues to lay much emphasis on industrialization in recent times can be enhanced with the aid of **Maslow's Hierarchy Needs Theory**. The theory is concerned with identification of factors and processes to which attention is paid in order to develop in people the willingness and the interest required before one can do anything at all (NTI, 1990: 105). The first part of the theory hinges on the premises that:

- Man has more than one motive at any given time; these needs are arranged in hierarchy in which there are lower and higher levels of needs; the lower needs have to be satisfied first before the higher levels needs can be satisfied; once a need is satisfied, other needs automatically emerge to replace the satisfied needs; and the lower needs can be satisfied much more readily than the higher needs which are more difficult to fulfill (NTI, 1990:105).

The second part of the theory deals with the hierarchy of human motives. It is represented schematically in a triangular form (fig. 1) where every person and nation struggle hard to reach the peak known as self-actualization or self-realization.

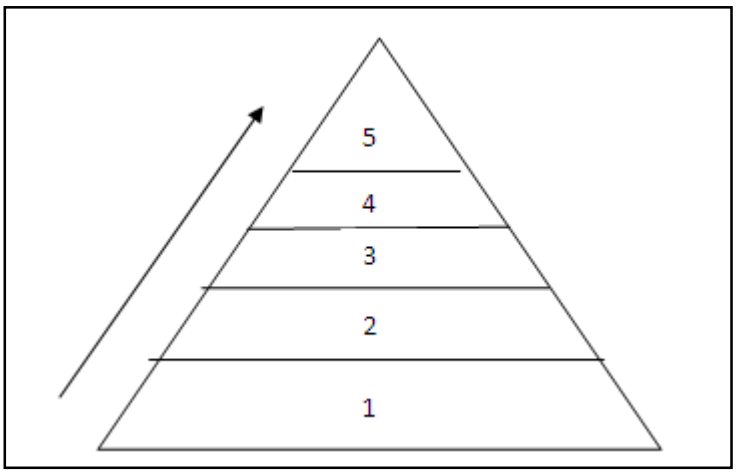

Figure 1: Maslow's Hierarchy of Needs Model

1. Physiological needs: e.g. need for food, clothing, shelter, rest.
2. Safety needs: e.g. desire for security, protection & freedom from dangers
3. Self-esteem needs:- e.g. desire for respect, confidence, admiration
4. Love and belonging needs: e.g.motives for friendship & companionship.
5. Self Actualization or self-realization needs: e.g. autonomy, independence originality, creativity, and self-fulfillment.

What is glaring in Maslow's Model is that in the life of a person or nation, the basic, physiological needs are first met before the secondary needs- comprising safety, security, belonging, self-esteem, intellectual achievement, aesthetic, autonomy and independence. As no nation would want to remain at the cradle stage, Nigeria in the past had an economy dominated by agriculture and revenues from primary sources such as oil &other solid minerals but now is not ready to continue depending on such primary products. Thus, in the last fifty years, the country has experienced increased activities in areas of exploration, exploitation, refining and products marketing operations to diversify the economy (Nwankwo & Ifeadi, 1988:208).

The power and wealth of the advanced countries of the world are based on industrialization and it is the aim of Nigerian government to also establish industries for self-actualization and self-realization. Being a responsible country in the African continent, Nigeria is aspiring to attain the highest possible level of development through industrialization in order to uplift the well-being of its people as is the case in highly industrialized nations of the world like USA , UK, Japan, to mention but a few. Hence, of recent it has embarked on different schemes and policies of industrialization which is believe to be the panacea to the existing problems of socio-economic development.

According to Ngutsav and Akaahan (2002:65), the industrial policies of some states, particularly Benue State involves such incentives as: establishing industrial layout; granting of tax exemption for new industries for a period of5 years, expeditious granting of application for acquisition of land for industrial establishment, making report of feasibility studies available to prospective industrialists coming to invest in the state; helping in clearing of land for citing of new industries on behalf of investors; and small scale industrial credit scheme to assist industrialists to expand their scale of operation. In line with **Maslow's Hierarchy Needs Theory**, Nigerian government's policy on increased industrialization is for self- actualization: hence has to showcase her creativity, originality, and autonomy and independence technology wise in order to emulate the More Industrialized, Technological and Economically Advanced Nations(MITEAN) of the world. Virtually every product we use, ranging from household products like building and roofing materials, cooking utensils, electronic gadgets to national such as automobiles, farm machinery, telecommunications and weapons for the defense of the nation are all products of industrialization.

Nigerian government is therefore working assiduously hard through good industrial policies in order to reach the peak of Maslow's Model for self-actualization: given the fact that industries are the bone of national development. They contribute to the country's GNP; create job opportunities; boost international trade and improves trade balance; stimulate other sectors of the economy; control inflation due to mass production of desired goods as well as help to diversify the economy to boost the nation's social, economic and political ego among comity of nations.

4. Locational Patterns and Trends in Industrial Development

Industrialization is the hallmark of development, it is a very potent force in the development process and can generate far- reaching changes in the society namely social, cultural, economic and demographic (Ottong, 1984:324). According to National Directory of Industries (cited in Okoye, 1997:266), Nigeria has developed significantly towards industrialization over the decades with over 5000 industries cited all over the country, covering three levels – primary, secondary and tertiary industries. The prominent manufacturing industries mentioned by Iloeje (2004:118) include: *food, beverages &tobacco industries; breweries & soft drink factories; paper & printing factories; cement works; chemical &petrochemical industries; iron & steel industries; engineering industries; and processing industries*.

One of the major characteristics of industries in Nigeria is that they are spatially distributed and relate very closely to the sources of raw materials. A number of Nigerian scholars (Ikporukpo, 2002:104; Iloeje, 2004:118; Emielu 2014:200; Segynola, 1988: 175- 178) have identified four broad areas of concentration of industries and some isolated areas like the five industrials towns: Ajaokuta, Kainji, Sokoto, Maiduguri and Makurdi while the major zones discussed here are:

- North-Central Zone: Comprises industrial towns like Kano, Zaria, Gusau, Kaduna and Jos where such goods like drinks, food products, textile, car assembly, leather products, petrochemicals, breweries, and ceramics, tin-smelting and steel rolling mill abound.
- South-West Zone: Comprises industrial towns like Lagos, Ibadan, Ewekoro and Shagamu where such goods like food products, power, chemical products, textile, boat building, car assembly, shoes and steel products are available.
- Mid-South Zone: Comprises industrial towns, like Benin City, Edo, Sapele and Warri where saw mills, glass factory, petroleum products, soft drink, brewery and power generation abound.
- South- East Zone: comprises industrial towns like Port Harcourt, Aba, Onitsha, Enugu, Calabar, Nkalagu, Umuahai and Opobo. Industrial works here include car assembly, petroleum products, drinks, power generation, chemical products, shoes and machine tools.

Of all the areas of concentration, the most significant are the Lagos – Ibadan axis and Kano City that account for over 60% and 10% of all the nation's industries respectively(Iloeje 2004:118). The reasons for the high concentration of industries in these zones are not unconnected with:

- The high concentration of population that provide ready market for the products; availability of raw materials and infrastructure needed by industries; government policy; economics of agglomeration; and accessibility to all parts of the world (Ikporukpo, 2002:104; Iloeje, 2004:121).

Period	Industry	Agriculture	Services	GDP	Per capita
1980- 1989	-2.1	2.9	2.7	0.8	-2.0
1990-1999	0.9	3.3	3.1	2.4	-3.0
2000 – 2004	5.1	5.3	6.1	5.4	3.1

Table 1: Economic Growth in Nigeria 1980 – 2004 (figures in percentages)
Source: Akande et al. (2008) pp 83

A cursory look at table 1 can provide some perspectives on industrial development trends in Nigeria. The data presented summaries the available evidence on economic and industrial development from 1980–2004. The industrial value added, consisting of crude oil, mining and manufacturing experience a 2.1% average annual decline in the 1980s but mildly recovered in the 1990s. The industrial sector experienced an improvement of about 1% growth compared to agriculture and services sectors that relatively grew at 3.3% and 3.1% respectively. In 2000- 2004, the industrial sector appreciated significantly in value added where it was five- fold increase, compared to other sectors,(Wayemi, 2008:83).
According to Wayemi (2008:83), the aggregate industrial trend presented in the table masks the development in the manufacturing sector. He maintained that the growth performance of the industrial sector was very impressive in 1960s and 1970s at 9.1% and 12% growth respectively, attributable to 'Internal demand pressures sustained by oil revenue inflows and import substitution industrialization strategy (ISIS) (Wayemi, 2008:84).

5. Ways and Processes of Environmental Degeneration through Industrial Activities
The early industrialization strategy of import substitution in Nigeria resulting in high concentration of industries more in towns, cities and regions is complicating the problem of maintaining the environment at a healthy level. This is because industrialization, like many other human activities makes great demand on the environment especially in terms of resource extraction emission and discharge of waste that pollute the living surrounding. Consequently, they run the danger of spoiling environmental assets in general and posing health problems not only to human beings but plants, animals and their source of livelihood. A number of researchers have work assiduously hard to identify ways and processes by which industrial activities do pollute the land, air and water in different parts of the world of which Tripathy and Panda's (1999:114) discovery can be summarized thus:

- Caustic Soda Industry: produces mercury and chlorine gas which pollute air, water and land.
- Cement Industry: releases dust and particulate matter which affect air, water and land.
- Distillery industry: produces organic waste effluents enough to pollute air, water and land.
- Fertilizer Plant: releases ammonia, cyanide, oxides of nitrogen and oxides of sulphur into air, water and land.
- Dye Activity: releases inorganic waste pigment which pollutes land and water.
- Iron & Steel Mill: Releases smoke, gases and coal dust which pollute air, water and land.
- Pesticide Factory: liberates organic and inorganic wastes into water and land.
- Oil Refineries: discharge smoke, toxic gases and inorganic waste into air and land.
- Paper & Pulp Industries: produce smoke and organic wastes into land and water.
- Sugar Mill: Produces organic wastes and molasses into land and water.
- Textile work: produces smoke and particulate matter which pollutes land and water.
- Tanneries: produces organic wastes into water.
- Thermal Power Plant: produces fly ash and sulphur dioxide gas into the air and water.
- Nuclear Power Station: produces radioactive wastes which pollute water and land.
- Food Processing: generates alkalis, phenols; chromates and organic wastes which pollute water and land.

Indeed personal experience of interacting with some industries during excursions and 'reports from research works on industries in the country' (Okoye, 1997:266) indicate that the issue of industrial pollution is serious. In most of the industries treatment facilities are either grossly inadequate or non- existence even if they exist many of them are dysfunctional. Unless urgent action is taken our environment which sustains the teeming population of this country would sooner or later be destroyed.

6. Implications of Increased Industrialization on the Environment
The continued accumulation of industrial wastes being generated through production processes is fast despoiling the once scenic and beautiful Nigerian landscape. The victims of industrial pollution are human beings, animals, plants, materials, climate and places of aesthetic value.

6.1. On Human Beings
Industrial pollution causes irritation of eyes, throat and respiratory tract and makes life uncomfortable. Dust and particulate matter and cement works when inhaled is known to exacerbate lung cancer while carbon monoxide increases heart problems and impairs driving skills with respect to brake reaction time, night vision, hand steadiness and depth perception (Amadasu, 2000:62).

6.2. On School Children's Academic Achievement
Industrial pollution is known to lower academic performance of children of primary school age. A study report by Hassel ball et al (as quoted by Amadasu, 2006:61) among children age 5- 13 years indicated that children in high pollution areas had an academic

performance significantly lower than their counterparts from low pollution areas and that the academic performance of these children improved during low pollution episodes.

6.2.1. On Animals

Industrial pollution affects animals when they feed upon the particulate –coated plants especially fluorine, lead and arsenic. These pollutants then accumulate in prey animals and subsequently poison others in the food chain. Lead poisoning also easily results in bronchitis and lack of appetite in pet animals that entertain human beings. In some industrial towns, industries deposit untreated effluents through canals into rivers, streams, lakes and seas to kill aquatic animals that human beings depend upon to augment their dietary requirements. Fish all over the world are vulnerable to pollution and the absence of fish from our table may worsen the protein- deficiency among many Nigerians and expose them to many diseases.

6.2.2. On Plants

The effluents of such pollutants like sulphur dioxide, ozone, nitrogen oxide, ethylene, proxy acetyl nitrate (PAN) and easily bleaches the leaf surface and causes loss of chlorophyll and yellowing of leaves of leafy vegetables. Nitrogen oxide causes premature leaf fall and suppress growth of plants, resulting in reduced yields of crop plants which human beings depend upon for sustenance of life. Poor crop yield is a threat to food security and may worsen the food situation among the poor Nigerians that make up over two-third of the population.

6.2.3. On Materials

Structures like buildings, monuments, statues, bridges, fences and railings are usually destroyed by corrosion, abrasion, chemical attack, deposition and removal of materials when exposed to industrial pollutants. Paints are usually discoloured by sulphur dioxide and particulate matters. Sulphur dioxide, acid rains and aerosols damage building materials, corrode metals and make paper to become brittle and leather to undergo rapid disintegration.

6.2.4. On Climate

Industries require huge amounts of energy to run the factory equipment and machines. They equally release into the environment such gaseous pollutants that easily form acid rain while others constitute greenhouse gases that trap outgoing heat to cause global warming. Global warming is causing climate change that is not just a threat to Nigerians alone but the entire global environment. Global warming is capable of melting the polar ice and highland glaciers which can exacerbate flooding of coastal towns like Lagos, Yenagoa and Port Harcourt with serious socio-economic consequences. The thinning of ozone layer in the stratosphere by the action of industrial aerosols accelerates the penetration of harmful ultra-violet rays of the sun to the earth and cause blindness, sunburn, inactivation of proteins RNA and DNA (Dhameja, 2006:174).

6.2.5. On Aesthetic Beauty

Industrial pollutants usually render places of resting and pleasure valueless. The aesthetic beauty of nature may be reduced with reduction in visibility caused by dust, smoke and smog in the air. The heaps of garbage emit foul odours to cause obnoxious smell which further lead to loss of beautiful sites, for recreation and tourism development.

7. Recommendation

The preceding section of this paper has shown that the deleterious effect of industrial pollution is not limited to plants and animals alone but can threaten human beings, adults and children alike. No organism, no matter how large or small can escape the poisonous wastes from factories. Viewed against this background the following steps are recommended as ways of controlling industrial activities aimed at curtailing the degeneration of Nigerian environment.

7.1. Close Monitoring of Industrial Activities by Government

Since government pays more to make the polluted water fit again for use, there is need to have some close monitoring of industrial activities in the country in order to have each industry's liability. Monitoring of industries would make each of them to consider the best response to adjust its operations that are incongruous with the serenity of the environment. The adjustments can take the form of effluent treatment, relocation of factory and charges in production methods or materials reduction. Government must insist that industrialists treat wastes before being allowed to be discharged into the environment.

7.2. Recycling of Industrial Waste

Recycling in the sense of the re-use of a given output is one of the most widely entertained mechanisms for extending the life of a resource and controlling pollution should be an agenda to pursue by the industrialists. In this wise, paper, metals and vehicles scraps that clog the streets and open spaces in industrial towns and cities of this country should be recycled for re-use. A good deal of empirical research on recycling and re-using behavior is necessary not only to develop methods for separation of usable materials from industrial wastes but also in marketing products. Government needs to provide adequate funds to tertiary institutions in this country to encourage research activities on industrial waste management strategies in order to help save the environment from becoming unfriendly to the occupants.

7.3. Environmental Impact Assessment (EIA)

Government should insist that prospective industries submit written report on the expected impact such industrial establishments would have on human beings, water, air, plants and animals before granting them license to operateor not to operate in certain locations.

7.4. Environmental Education

There should be large-scale information dissemination in various dialects for the people on the deleterious effects of industrial pollution and the need to move out of all industrial zones to avoid being exposed to health hazards. Industrials workers on their part should be advised to always maintain safety measures to curtail the degree of exposure to industrial pollution including noise from production machines. The general public especially those residing close to industrial zones should be advised on the need to plant trees in order to reduce the effect of harmful industrial discharge, as plants act as carbon sink.

8. Conclusion

Industrial activities in Nigeria are on the increase in recent times. It is a potent force for rapid economic development for self-actualization. However, the paper has established that unchecked and unmonitored industrial activities lead to the production of huge wastes being manifested in pollution of water, air and land. The paper has recommended some measures to take in order to reverse the unfortunate trend in order to save human health, animal's plants and non-living elements of the environment from degeneration.

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