EFFECTS OF THE PROLIFERATION OF COTTAGE VEGETABLE OIL FACTORIES ON THE RURAL ENVIRONMENT OF SOUTHEASTERN NIGERIA

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ABSTRACT

Vegetable oil industrial activities, like other industrial ventures, create wealth and quicken development rates. However, they have negative consequences on the environment. This industrial pursuit generates oxides of sulphur and Nitrogen, carbon monoxides, particulates and aerosols that pollute the air; oil chaffs, spills and solid, wastes to the land and discharges oil effluents into water bodies in the southeastern Nigerian rural areas. Socio-economically, it boosts income but brings in some social problems as job seeker drift towards these industrial areas. Proper environmental sustainability practices employing the advanced mitigation measures would guarantee equitable operation of the vegetable oil industries without shortchanging the senere status of our rural environment.
Keywords: *Vegetable oil, Industrial pollution, Environment, Sustainability and Mitigation.*

INTRODUCTION

Today the industrial and technological level attained determines how developed a nation is. For instance, the 1994 tabulation of developed nations showed Japan as the first, followed by the United States of America. Their high industrial and technological feat earned them top ranking positions among the world's developed nations. Industrialization is accepted by the third world nations as an avenue to proffering solutions to their multi-dimensional problems such as socio-economic debt burden and poverty. Nigeria has embarked on various industrialization plans, strategies and polices because they provide employment opportunities, raise the general standard of living, boost income, pay off both national and international debts, and promote export and technical skills.

The wonderful gains of industrialization notwithstanding, a spontaneous conflict in the minds of environmentalist take place with the juxtaposition of the words "industry" and "environment". It conjures-up awesome imageries of spewing noxious plume from industrial stacks, gushing toxic effluent from their waste pipes and lethal radio-active fall outs from their solid waste chutes and bins, encroaching into serene and untampered natural environment. As a matter of fact, industrial growth and environmental protection standout in this scenario and are viewed as mutually exclusive as the requirements of the former for raw materials and outlets for waste override the demands of the latter. There are a number of evidences buttressing this conflict, right from the origin of man. However, these may not rigidly follow as they

appear. Natural resources extraction, processing and management are purely legitimate practices, in so far as they are sustainably carried out. Naturally, every organism utilizes the natural resource within their reach in order to exist. Man is not an exception. Human impact on the environment is two-pronged:

(a) Removal of natural resource

(b) Discharge of the externalities to the environment

These cause pollution, alters critical parameters of global circles and destroys habitats at rates and on scales that are unmatched by other organisms (Price, 1983). It is a clear fact that humanity is purely dependent on natural systems. With all the available technological sophistications, our food is still absolutely from photosynthesis; we source all our valuable raw materials for industrial activities from natural sources and breathe air whose constituents are as a result of natural process. Wards and Dubos (1972) summed up the basic essential of the human situation: *"The pathway of organic development has been shaped by interactions with other components of the natural world. Today we still depend on that world for our survival for breathable air, drinkable water, food and above all, for the sun's energy which drives the complex system of living things"*.

Unsustainable industrialization is the bane of development. Since industrial development is the foundation on which the present civilized and developed nations stand, it is highly encouraged provided the environment is fully protected. Securing or protecting the environment does not strictly mean complete preservation of its status quo, irrespective of the need to use it. Rather, the rational and sustainable utilization of natural resources is what conservation is all about. There are instances where it refers to comparatively little restrictions in extents or intensities of exploitation and in other cases, it could mean the protection of some particular areas or resources from degradation. Whole-hearted allegiance should be paid in the protection of the environment. It is improper to apply apparent protective measures only to craftly enmasse the benefits without considering the costs on the environment. Instances are abound where faulty and leaking nuclear fuel processing plant and lead-acid accumulator battery industries emit toxic radio-active matters into the environment. The management would merely plant pollution-resistant trees around it. Infact, the environmental implication of these will extend beyond the industries premises in due course. Environmental pressure groups such as Friends of the Earth, Earth Search, United Nations Environmental Programme (UNEP) and Wild World Fund (WWF) criticize such callous attitudes to the environment.

Issues of impact of industrialization on the environment are only viewed seriously when they become embarrassing to government. This view could sound cynical but the complacent attitude of various past administrations towards the adverse effects of asbestos, petroleum extraction, vegetable oil, petrochemical and fertilizer, and cement industries would prove otherwise. Also the destruction of potential wildlife reserves for the development of new states, federal capitals and government reserve areas; the ecological disruption of acquatic life by the demaing of the River Niger for

the Kainji Hydroelectricity project for industrial progress. However, there are great hopes for sounder governmental stand on environmental issues in the future, but, Paul (1993) speaking for industrialization has an opposing view that raising of higher and higher environmental standards in a country will increase production costs, thereby hiking prices and will ultimately lower the nation's competitiveness in international trade.

Nigeria is greatly endowed with vegetable oil crops. Palm oil and palm kernel oil are the dominant of all vegetable oils. It is about 70% of Nigeria's fat and vegetable oil production. The others are groundnut oil, castor oil, beniseed oil, banbassa oil, shear butter and coconut oil. The nation continued ranking highest in vegetable oil exportation until the fall in the 1970s as a result of the petroleum oil boom.

According to FAO (1983), other factors which led to the fall in vegetable oil production in Nigeria are: the civil war, devaluation of the Naira, high domestic inflation, unfavourable climate changes, low level of technology, pests and diseases. Then Nigeria became an importer of vegetable oil until the ban in its importation. This triggered off domestic production to meet the high demand. The southeastern Nigerian, especially, the rural communities, is heavily endowed with palm produce which is the principal natural resource of the area. In fact, the University of Nigeria was initially set up with fund from the Eastern Nigeria Palm Produce Board. The people resourcefully use derivatives of the palm trees ranging from the palm wine to the cooking oil, their roofing materials to sweeping brooms, the basket making fibres to the palm kernel oil for soap making. Mbagwu (1975) remarks that oil palm are produced in bulk within these areas of Nigeria. He also observed the importance of oil palm economy to the area, hence the proliferation of small and large scale vegetable cottage industries in the area.

BIO-PHYSICAL SETTING OF THE STUDY AREA

The biophysical setting or the existing natural environment before the springing up of the vegetable industries show that it was "ab-initio" serene and untampered with. The peacefulness and serenity of nature was at its best.

Hydrology: Runoff water generation from each rainfall was enormous. These flow downslope into shallow channels, furrow and rills formed from footpaths and land boundary grooves and finally into streams which are either tributaries or distributaries of major rivers. These rivers include Ebonyi, Anambra, Cross River, and Imo among others. Most of them flow into the River Niger and others into the Atlantic Ocean. The predominantly sandy clay soils have high infiltration potentials. Accumulated soil materials from erosional activities present siltation problems which reduce river channel capacities. Ponds and lakes are formed at plains and lower course of rivers.

Topography: The area shows a predominance of plains under 200m above sea level. It has a characteristic topography of slow ascent from the south to the highest points of Obudu Plateau, Nsukka-Okigwe Cuesta and Awka-Orlu uplands. The plains are the result of aggradational materials from the denudation activities on the highlands.

They are composed of sedimentary rocks which are largely sand stones shales and clays of cretaceous and Tertiary ages. The plains extend form the Anambra plains which streches to the Cross River areas. The plain at the Niger Delta swampy areas is known as the coastal plains.

Air Quality: The air polluting agents are both natural and man-made. The natural sources were from lightening-ignited forest fires, wind - propelled dust and harmattan haze. Vehicular exhaust emission, industrial activites, bush burning and burning of fuel wood for cooking are artificial sources.

Ecological status: The floral characteristics of the area is dictated by the vegetation. The derived savanna wood land is the vegetation of the northern and most parts of the central areas. It is characterized by grass of different species such as elephant grass, gamba grass *Andropogon tectorum* and bahama grass *gynodium dactylon*. Tree species include palm trees, pear, mango, African mango, orange, cashew, breadfruit. Agricultural crops are cassava, groundnuts, yam, okro, maize among others. The faunal species include cane rats, squirrels, rats, lizards, birds such as wild partridges, guinea fowls, egrets and falcons, also hyenas, deers and wild cats.

The rainforest is found in the southern parts close to the Atlantic Ocean. At the fringes of the shores is the mangrove forest swamps. The plants in there forest zone are raffia palm, oil palm, mangrove plants; bread fruit, wide variety of creeping and climbing twig species, alligator pepper, ferns, iroko, mahogany. Agricultural plants include water yam, fluted pumpkins, melons, water leaf, yam and cassava. Elephants, monkeys, snakes, toads, snails, earthworms, fishes, crabs, vultures, kingfishers and eagles are faunal species. Domesticated animals include chicken, pigs, sheep and goats.

SOCIO- ECONOMIC SETTING

The population density of the rural areas of southeastern Nigeria ranges from 580 to 651 persons per square kilometer (NPC, 2006). Higher value within this range can be found in Imo and Anambra states. The rural areas suffer the present rural-urban drift. Human settlement patterns are mainly conglomerated. However, few agglomerate settlements are available. Others, mainly the elites, settle axially along major roads that link one town to the other. People are attracted to settle along the sides of such roads because they are prone to development. The age profile or distribution within these rural communities portrays a glaring vacuum in the male youths of 17 of 30 years age-bracket or segment. The rural-urban drift is responsible, for this. The predominant age segment found are infants for both sexes, teenagers (both sexes, see Table 1).

Table 1: Predominant Age Segment Available in the Rural Areas of Southeastern Nigeria

Age segments	Age bracket	Sex mainly available
Infants	0-6yrs	Both sexes
Below teenage	7-10yrs	"
Teenagers	11-20yrs	Faily both sexes
Youths	18-35yrs	Female sexes
Middle age	36-45yrs	Both sexes
Old age	46 and above	Both sexes

Source: Fieldwork 2009.

Farming, indigenous processing of farm products, fishing, palm wine tapping, craft making, blacksmithing, cloth weaving are traditional occupations of the area. They cultivate the land and keep livestock's such as pigs, goats and chicken. Other economic activities include training, driving, teaching, civil service employment, building, carpentry, mechanic work, and traditional medicine and birth attendants. Some work in the urban areas and retire to the rural areas at dusk such as mechanics, shopkeepers, hair dressers and traders. Children of school age attend primary and community high schools within their communities.

IMPACT OF THE PROLIFERATION OF VEGETABLE COTTAGE INDUSTRIAL ACTIVITIES ON THE ENVIRONMENT

The multi-dimensional activities that are involved in the processing of vegetable oil in the study area produce both negative and positive impacts. These can be segmented into noise, air, land, water and socio-economic impact.

Noise/Vibration Pollution: The entire construction phase of these cottage industries such as site clearing, foundation excavation, concrete mixing, carpentry works cause a lot of noise. Actual industrial activities such as hauling in and out of raw materials and products, kernel cracking, mixing, extraction, compressing, churning and heating by electric powered equipment create much noise and vibration. The noise and vibration disjoints the oil structures, destabilizes and displaces the micro-ecosystem. Birds and animals migrate. It causes acoustic trauma, partial deafness, insomnia (sleeplessness), hypertension, physiological stress, neurotic problems, irritation, and nervous disorder to humans. Attenboroug (1972) remarks that noise disrupts communications, educational processes, conversations and other mental activities. Noise and vibration can however, produce positive impacts such as the migration of termites, snakes and other dreaded reptiles.

Air Pollution: Hauling in and out of raw materials (palm kernel nuts and fruits) and the finished vegetable oil respectively from the industries generate vehicular exhaust fumes. Industrial activities such as diesel generator sets, boilers, heating of the raw oil to remove water, release fumes, smug and oil aerosols. The smug contains oxides of sulphur (SOx), oxides of Nitrogen (N0x), carbon monoxide, carbon particulates, hydrocarbons, photochemical oxides, lead particulates, carbon fluorocarboned (CFCs), Ketones, esters and hydrogen sulphide (Canter 1977). Oxides in the smug react

photochemically producing mists such as sulphuric, nitric and carbonic acids that latter come down as acid rain. The pollutants cause respiratory problems, such as asthma, bronchitis, lung cancer, cough and chocking. Other effects include eye irritation and visual impairment from the oil aerosols and vapour. The charged and polluted air causes the annihilation and migration of air-borne micro-organisms, insects and birds in the vicinities of such industries.

Table 2: Industrial Air Pollution (Emission Standard)

Pollutants	**Toxicity (concentration)**	**Effects**
Sulphur oxide	300mg/m3 for 3-4 days	Cough
Carbon monoxide	35 mg/m3 for 8 hours	Chocking
Photochemical oxide	300 mg/m3 for 3 days	Eye irritation and brain damage
Hydocarbons	100 mg/m3 for 4 hrs	Blood poisoning
Nitrogen oxide	156 mg/m3 for 24hrs	Respiratory disease
Particulate matters	80 mg/m3 for yearly avg.	Visibility problems

Source: Canter (1977)

The Toxic substances dissolved in rainwater destroy non-resistant plants, cause diseases such as mealy bug and black stakota on cassava and plantain respectively, contaminant the soil as well as under groundwater.

Land Pollution: Industrial activities involved in vegetable oil production are various. These include boiling, churning, extraction and dewatering by evapouration. These activities generate immense externalities in form of solid, liquid and gaseous (vapourized) wastes and these degrade the land. The oil vapour that settles on plants coat their leaves thereby inhibiting their growth and other biochemical processes such as photosynthesis, transpiration, and physiology. This also impairs their geo, hydro and phototropic abilities. Disposed oil wastes hardens or solidifies the soil surfaces and as such, prevents the efficient penetration of plant roots, air, water and decomposed organic matter into the soil. It also destroys certain nitrogen-fixing bacteria and organisms that promote plant growth and sustenance. The presence of oil wastes infiltrating into the soil, annihilates or drastically retards the reproductive rates of earthworms, insects and other micro soil fauna that aid the processes of decomposition of organic matter for the improvement of soil organic matter status.

Buried solid wastes melt and leach with time. These pollute underground water in acquiffers and are shown in water fetched from artesian wells in the study area. Dumped oil wastes degrade the entire aesthetic value of the land. They emit odours as they decompose. This constitutes a terrible health hazard to inhabitants. The general aesthetic value of the environment is degraded and deteriorated. The stench from decomposing solid wastes is noxious health hazards. Scavergers such as pigs, vultures and falcons are found in the waste dumps and this constitutes eyesores. The natural soil colour is lost to oil stains and blackend by spills and waste litters. The palmitic and fatty acids in this vegetable oil have corrosive effects on rooftops when they settle on them as oil vapour.

However, on the positive side, the hardening of the soil surface by oil prevents wind erosion and dust storm pollution during windy periods.

Water Pollution: Usually industrial wastes find their way into water bodies through runoff flows and into underground, through seepage or leaching. The pure and natural state of there water bodies as well as their faunal and floral micro- organisms get contaminated with these wastes. Sometimes vegetable oil wastes are directly dumped or discharged into these water bodies. This leads to the extinction and migration of these aquatic organisms. The portability of the water is usually lost. Also the fishing, recreational and aesthetic values are at stake Effluent from the vegetable oil industries makes surface water bodies turbid. Some of the waste materials form sludges in the water and this impedes spawining of fishes and other aquatic fauna. The oily film formed on the water surfaces by these wastes blocks off oxygen, thereby increasing the biological oxygen demand (BOD) in the water. This suffocates aquatic faunae such as fish, crabs, mosquito larvae and tadpoles. Sunlight is prevented from penetrating into the water by the scum produced by the wastes. This impedes the processes of photosynthesis of algae, planktons, spyrogyra and other aquatic green flora. The growth and reproductive rates of fishes and other aquatic animals are drastically reduced form the ingestion of palmitic and fatty acids wastes. Certain compositions of these wastes (Table 3) have carcinogenic and mutagenic effects on these animals. Insects have their wings coated with oil and this makes them too sticky and heavy for flying.

Vegetable oil cakes are rich manure. They support water weeds causing euthrophication of streams and rivers. Vegetable oil industries sometimes go into allied manufacturing of soap and detergents. The chemicals involved are sodium chloride, caustic soda and sodium stearate. These react with other elements when discharged into streams. They increase the streams salanity and chemical load, hence depleting the available oxygen needed for living organisms. Effluents from vegetable oil destroy acquatic life in two ways. First, by direct or primary toxicity where it interferes with the structures or functions of various organs of plants and animals, thus killing the organism. Examples are hatching fish eggs, germinating seeds, growth and reproduction of some micro-organism which can be completely inhibited by oil coating. Secondly, by indirect or secondary toxicity where it prevents gaseous exchange across air-water, aerobic organisms die off due to oxygen deficiency. It also has long term and slow forming effects on these aquatic organisms which manifest histological, physiological and behavioural changes. Water pollution drastically declines fishing, swimming and boating for recreation as well as and dry seasons farming by irrigation.

Table 3: Average composition of palm oil and palm kernel oil

Constituents	**Palm oil**	**Palm kernel oil**
Palmitic acid	42.5%	7.8%
Myristic	1.0%	15.0%
Stearic	4.0%	1.5%
Oleic	43.0%	16.0%
Linoleric	9.5%	1.0%
Sponificaiton No.	195-205	245-255
Iodine No.	44-58	12
Specific Gravity	0.898-0.901	0.86 - 0.87

Source: Doss (1982).

Socio-economic Impacts: In the areas where these vegetable cottage industries are operated, the population tends to increase as both temporal and regular workers are involved in the work. They rent houses and this enhances the value of the houses there. Food cafeterias, drinking bars, provision shops and workshops spring up. This boosts the socio-economic status. Occupational adjustments and changes are noticed as some farmers, house thatchers and palm wine tappers now take to working as operatives in such industries. Employment opportunities are on the increase hence improved standard of living.

The landuse pattern is changing. From agrarian purposes, it changes to building of shops, rentable rooms, and workshop for technicians and roads. Social amenities such as electricity, pipe-borne water and health centres will be attracted. The industrial activities has feasible and economic viability to investors, provides employment to people and boosts the Gross National Product (GNP) and Gross Domestic Product (GDP) of a country with self sufficiency in raw material production of soap, polish and detergent. On the negative side, as more people migrate there for commercial and industrial activities, shady characters such as con-men, thieves, prostitutes and drunkards will also infiltrate the area causing social problems.

CONCLUSION AND RECOMMENDATIONS

Industrialization and technological growth are not only indispensable but are yardsticks for the measurement of the development index of a nation. There is a need to strike a balance between industrial activities and management of its enternalities and the affected biophysical and socio-economic environment of the study area. The proffered mitigation measures should be stringently applied so that we stand on the tenets of the global environmental summits which advocate the use of environmental resources without jeopardizing the chances of future generations. These measures are also replicatable for use in other areas where similar environmental problems may occur.

Man may appear apologetic over abuse of the environment but would not compromise his pursuit for industrial activities. Burney (1981) noted that the unprecedented speed with which we are developing and using substances has outdistanced our ability to determine or control their composite impact on the environment. We are then left with no other option than sustainable mitigation measures, since there is always a silver lining behind every dark cloud.

Environmental Impact Assessment (E.I.A): Environmental Impact Assessment of vegetable oil and other allied industries must be carried out before they are set up. This would help to determine the likely impacts of such activities to the immediate and distant environment. It also provides mitigation measures for any environmental problems that could emanate from the industrial operations.

Fluidized Bed Combustion: This technology ensures minimal emission of pollutants in the heating and combustion processes in industries. It can also be used in the

vegetable oil industries. Also smoke coal briquettes which produce less pollution than ordinary coal can be used. To minimize sulphur dioxide pollutants, powered limestones or dolomites can also be used in the combustion systems.

Rural Electrifications: The study area falls within the rural areas. The effort of government to electrify the rural areas should be promptly completed. This will stop the pollution problems of fuelled generators as will as reduced the noise they generate to the environment. If this is achieved, powering of the industries with electricity becomes more environmentally friendly.

Waste Treatment: Proper stacking or pilling of the industrial wastes in well constructed waste shades where they can be treated and used as manure would prevent their degrading of the environment. The effluents should be subjected to improved biotechnological effluent treatment methods where aeration, sedimentation, cooling and emulsification will neutralize the palmitic and fatty acids as well as lipids in the effluence before their discharge into steams or soakaway pits.

Landscaping and Reafforestation: Bare land areas should be landscaped as will as intensive tree planting (reafforestation). This is with a view to prevent soil erosion and provide plants that can absorb some of the harmful air pollutants from the industrial operation. Obaseki and Ohonba (1998) remarked that one hectre of wood land can absorb 400kg of Sulphur dioxide (SO2) and 100kg of chloride.

Wind Rose Diagrams: Proper planning, location and orientation of these industries taking the wind rose diagram into consideration should be done. This will prevent the blowing of smug from the industries by wind into human settlements or schools.

Environmental Awareness Education: Sound environmental education and awareness is very vital in environmental management. Local participation or people participation in workshops and public awareness talks on the environment is necessary. This awareness education should transcend the primary schools to tertiary institutions. Introduction of environmental extension officers who would create and disseminate this education in the rural areas or grassroots is useful. In its "clean up the World Programme", UNEP (1993) promoted global environmental awareness.

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