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Assessment of Health and Environmental Challenges of Cement Factory on Ewekoro Community Residents, Ogun State, Nigeria

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The impacts of industrialization on socio-economic development cannot be over emphasized, but so are the negative consequences. This paper examines the health and environmental challenges of Ewekoro Cement Industry on the physical environment of the surrounding settlement of Ewekoro, Ogun State. This was with a view to providing sustainable solution to the negative impact of large scale industries in an emerging economy like Nigeria. The study involved empirical observation and interview of residents of the area. About 200 questionnaires were administered randomly on workers and residents, out of which 172 were returned. These were analysed using simple tables. The study confirms extensive incidence of land, air, and noise pollution over and above recommended minimum limits. It also discovers lack of substantial compliance with the principle of environmental integrity sustainability and National Environmental Standard Regulation Authority (NESRA) in terms of environmental resource protection. The study recommends that, for Nigeria to maximize benefits of industrialization and minimize its negative effects, a tripartite arrangement that involves, the industry, the community and the government must be involved in environmental monitoring and protection.

Keywords: environmental problems, health problems, environmental health, environmental impact, sustainability

Introduction

One of the often touted solutions to the problems impeding development in the third world countries is the emphasis on industrial enterprises. The intention behind the encouragement of industries, according to Ofori-Cudjoe (2009), Endashaw (2009) and Boakye (2010) lies in the development of a diversified economy that could propel the achievement of stable and sustainable societies, since the agricultural sector, the main economic activity in Sub-saharan African countries cannot provide enough employment and income to the growing population. Few years after Nigeria's Independence; the major economic policy emanating from the new government was that of import substitution (Oyebanji, 1983). The policy emphasized local production of hitherto imported consumers' goods by importing semi and unfinished goods that are fully processed into the country. Consequently, several large scale industries were built by the various levels of governments and individual that was desirous of quick industrialization. One of such industries is the Ewekoro Cement Plant in Ogun State. However, industrialization like every phenomenon just like it has benefits it also has negative consequences. In an attempt to maximize the benefits and cost in term of environmental crisis minimize the cost, governments all over the world have come up with standards which industrial plants especially pollution intensive ones must comply with before such industries are approved and established. The requirement of Environmental Impact Statement before development under the Federal Environmental Protection Act of 1987 is a bold attempt at controlling such noxious effects of pollution intensive firms like Cement Plants. However, several years after the promulgation of this law, many communities hosting large cement plants like Ewekoro in Ogun State has had to live with serious environmental problems following the operation of such industries. The results of this anomaly are many: they include continuous depletion of environmental resources, pollution of surface and underground water, and visual ugliness among others. All these have considerable implication on well-being and health of communities where such industries are located. It is on the basis of the above that this paper investigates the overall consequences of West Africa Portland Cement Industries on the Ewekoro environment. It is also meant to determine residents' perception of the effects of the industry on the environment.

Literature Review

Industries have generated a surge of interest among environmentalists and planners who are interested in

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the environmental impacts of industries. In recent years, scholars such as Scott (1998) and Pallen (1996), have tried to analyze the correlation between environmental damage and the growth of industries particularly in developing countries where the growth has been phenomenal. According to Scott (1998), the environmental impacts of the industries in the developing world have tended to be ignored. Although the promotion of such enterprises is seen as a way to provide employment and incomes, there is little evidence available on environmental impact and sustainability of such industries to guide decision makers.

There is no consensus, however, about whether small scale industries are more pollution-intensive than large-scale industries. Some argue that small scale industries may be more environmentally sustainable because of such factors as informal community pressure and regulation (see Puga and Venables, 1996). But there are also contrary views.

As Braden (1994) noted, small scale industries "often pollute more per unit of output than large firms operating in the same sector." This has variously been attributed to their failure to employ more efficient, updated technology; the difficulty of monitoring their compliance with regulations; their inability to safely dispose of the waste they produce; and their limited awareness of the potentially harmful effects of their activities. The question often asked by the scholars is- should policy makers be concerned about the environmental costs associated with measures to promote large-scale industries? Are they right in believing that the poor are overrepresented in this sector? Is their concern that regulation aimed at attenuating environmental costs would come at the price of exacerbating poverty?

In Brazil it was discovered that large scale industries contribute a non-negligible share of total pollution loads. However on the aggregate it was discovered that small scale Industries accounts for 62% of industrial pollution in Brazil. This provides evidence for the national policy in regulating small and large scale industries.

However this presents a dilemma. Will stringent environmental regulation of industries still at early stages of development not worsen poverty in the developing countries and particularly in Nigeria? For example according to Ferreira, Lanjouw and Neri (2003) when stringent environmental regulations shuts down many industries in Sao Paolo in 1997, poverty increased by 83% when they joined the pool of informal sector workers and the unemployed, and by 72% when they joined the general working age population.In his investigation of impacts of the industries in urban environment in India, Pallen (1996) asserts that although many firms are resourceful in many respects they can also be very environmentally problematic. When engaged in industrial activity they create more pollution per unit of investment because they operate in poorer, more populous neighborhoods, this pollution can have more disastrous consequences. Clustering offers clear economic advantages but may also create negative environmental consequences especially when heavy polluters dominate the cluster. Large sections of towns such as Kashur have been seriously damaged by the proliferation of tanneries in the core of the city, which created significant health problems. This assertion was supported by Oyelakin-Oyelarin (1997) in his study of industrial clusters of Nnewi, where heavy industrial polluters have changed the landscape of the town. All these problems have made the attainment of environmental sustainability difficult.

The concept of environmental sustainability is a fairly new formulation in the development thought. The most widely used definitions of the concept of sustainable development, comes from the United Nations World Commission on Environment and Development, which defined it as the "development that meets the needs of the present without compromising the ability of the future generation to meet their own needs (UNO, 1996).

According to Rowan-Robinson, Ross and Walton (1995) sustainable development has no precise legal meaning. It is a policy goal. The essence of sustainability is that the future should not be sacrificed for short-term advantages.

To quote the UN Brundtland Report (2008), all our needs should be met in a way which does not compromise the ability of future generations to meet their own needs. This view emphasizes how decisions and actions today can affects the future especially in relation to natural resource availability environmental health, and destruction of local and global ecosystems and most importantly the livability of our cities.

The Study Area

Ewekoro is one of the villages along Sango –Ifo - Abeokuta expressway of Ogun State of Nigeria Ewekoro borders Papalanto in the west, Abeokuta in the East and numerous villages along the northern and southern axis. The climate is not different from that of these towns and villages earlier mentioned and adjoining towns such as Ifo Sagamu and others. However, the coming of West African Portland Cement Company (WAPCO) changed the economic sphere of this once sleepy and serene town. Although quality limestone has been discovered in this

settlement since the colonial period, mining and quarrying did not commence until early 70s when attempt were made to mine and export. However as a follow up to the first and second National development plans the company was established with Lafarge of France being the major technical partner. The company has since been privatized.

Methodology

The study involves fieldtrip to site, empirical investigation, observation and interview of selected residents of the study area. This, primary and secondary data sources as well as reconnaissance survey were employed. The primary source consists of two hundred (200) structured questionnaires that were administered on both the workers and the residents of the area, out of this, one hundred and seventy-two (172) questionnaires were completed and returned.

The questionnaires were administered on the workers (outside the factory) and residents on a systematic random sampling technique which was adopted for questionnaire administration (one out of ten houses), targeting the heads of households. Simple statistical analytical techniques like frequency distribution were adopted for the data analysis.

Cement manufacturing process and products in Ewekoro

Ogun state of Nigeria is made up of high quality isolated limestone deposits such as those in Ibese Ewekoro and Papalanto. The process of mining is usually open cast method. This simply means that extensive virgin lands will have to be cleared and tilted before graders and loaders will be used to load and transport limestone to plant site.

Portland cement is manufactured by heating a finely grounded and carefully blended mixture of limestone and shale and red alluvium to a high temperature of 1500^{o}C (2700^{o}F). Although the first patent for Portland cement was granted to an Englishman, Joseph Aspdin in 1824, it was not until the end of the 19th century that Portland cement, with a similar chemical and mineral composition to that of current cements was produced using shalf or bottled kilns.

The first fully operational wet process rotary kiln were installed for clinker manufacture until the 1950 when the first Lepol, or semi dry kilns were introduced. The late 60s and 70s saw the introduction of even more efficient suspension pre heater process, and the 80s the precalciner process. In the late 80s and early 1990s, increasing emphasis has been placed upon automation and centralized plant control with benefit to product quality and host of product.

All the four of these different cement making processes are in use throughout the world. Essentially, they differ in the means by which the raw materials are dried and preheated prior to final heat treatment in rotary kiln. The control of clinker composition has advanced from the volume proportion arrived at by trial and error in the late 19th century to precise control using rapid x-ray fluorescence techniques. The continuous improvements in manufacturing methods and quantity control enabled the strength developed by Portland cement kiln standard laboratory test to increase progressively. This process often leads to serious environmental problems which is the subject of this investigation.

Results and Discussion

The discourse on environmental impacts of the cement industry is conducted under two broad operational divisions - the mining section, and the production section.

Effects on natural environment

Limestone mining in Ewekoro has resulted in conversion of farmlands into quarry sites. The house types on the site are mainly the make shift ones built for use on no permanent basis. The houses are mainly used as shops and stores for the products of the factory. These houses were built without recourse to planning regulations and so could pose health hazards to occupants. One very important impact of the quarry is deforestation. This simply means the loss of vegetation cover that is necessitated by the need to move equipments to the site, removal of the topsoil or (overburden) stemming of explosives and removal of blasted limestones. These effects are normally reduced by appropriate mitigating actions such as massive reclamation of the mined areas using new overburden materials and a forestation programme that involve planting of varieties of trees that have ornamental values, can hold the soil structure well and could cover the exposed land well. Limestone mining in Ewekoro had resulted into the conversion of many farmlands and settlements into quarry sites. The house types on the site are mainly the makeshift type built for use on no permanent basis. The few landowners on the factory site are resident on site to participate in cement business and no longer to farm as it was before now. The West Africa Portland cement according to the management made frantic

effort at re-settling the landowners in the estate built very close to the factory. But since this was rejected, a programme of gradual takeover of the old farm site had started. In the course of using the quarry, farmers had been stopped from the site and the cutting/felling of the trees continued, resulting into a large Expanse of land exposed to rain water and wind. The lake created as a result of blasting of limestone and release of water from within the Limestone deposit ordinarily should serve as habitat to fresh water fish, this has however not been developed. The ammonium compound washed into the lake from its primary source (explosive materials) may serve as manure and may encourage the growth of plankton, algae and aid the liming of the lake and encourage fish production. However, the possibility of having an excess quantity of the ammonium compound washed into the lake may pose a serious hazard on the lives of the aquatic animals. Aside from this the level of vibration and noise by earthmovers at quarries are supposed to be kept under control at least to fall within the limit allowed by Federal Environmental Protection Agency (FEPA). These factors are monitored using vibrogram while keeping the vibration level at less than 50 mm per second and the noise at below 120 dB (decibel).

Proper stemming of the explosives which are dangerous in themselves, in the dug holes is supposed to be encouraged to avoid surface stemming. Proper and burying of the explosives at the appropriate dept ensures reduced noise and controlled blasting. The empirical investigation by the authors reveals that there has not been substantial compliance with this guideline thereby exposing residents to avoidable inconveniences.

Another factor that has contributed to poor environment at the quarry site is the rising of dust during blasting and haulaging. In this case, the health concerns of the work force come to the fore. Silica exposure is an ancient hazard which has remained a serious threat to many workers including sand blasters, stone crushers, those involved in drilling, quarrying and tunneling through the earth crust. Diseases associated with the inhalation of silica-containing dust include silicosis, chronic airways obstruction and bronchitis, tuberculosis and lung cancer. Many workers including those in high-risk settings are exposed to crystalline silica. Wetting of the site road with water is carried out to reduce only the fugitive dust. Empirical observation reveals that while most of the workers are protected, the residents in the community are exposed to the dust during production process. Out of the 172 people interviewed 34 or 19.7% reported prevalence of asthma, while 19 or 11% reported exposure to heart diseases (Table 1).

Table 1. Diseases associated with the factory

Disease	Frequency	Percentage
Asthma	34	19.77
Heart disease	19	11.05
Skin cancer	24	13.95
Diarrhea	9	5.23
No disease	56	32.56
No Response	30	17.44
Total	172	100

Water is generated in large quantity in the process of drilling and blasting in the quarry leading to erosion and the washing of the left over of the explosives mainly ammonium nitrate into the pool formed due to the erosion. Many farmers have had their farmlands washed away by erosion and flooding during rainfall. In Ewekoro works, an artificial dam has been constructed to hold the water generated from the blasted limestone. The body of water is used for fish farming and the water is also pumped into the factory after treatment as processed water and for cooling purposes in the new plant that is located within the quarry. Good as this is, it also poses health problems. Stagnant water is a breeding spot for pathogens such as mosquito, which causes malaria. More over soil compaction has resulted from hauling equipments such as the drilling machine, scrapper, pay loader, bulldozer, dumper etc used in quarry, making forestation in such area very difficult. Blasted areas that are refilled and regenerated are allowed to fallow for a minimum of five years for full yield (agriculturally) to be achievable on such soil but shortage of land for agriculture among the populace are forcing people to re-cultivate such areas before they could fallow, thereby worsening the problem of soil erosion. Compacted areas are supposed to be blasted when no longer in use as tracks and later regenerated for fast recovery. Empirical observation has not revealed this.

Another important impact of the activity is oil spillage. This comes from such sources as the primary and secondary crushers, mobile plant workshop and sites, oil drum and tank sites in stores, kiln sites, compressor houses and sites, through leakages and spillage this can have quite an impact if it finds its way into water drainage within and outside the factory.

It can also lead to quite an ugly site if allowed to accumulate on a given site. Such measures as checking the oil seals regularly and following a well guided disposal programme for such oil would have prevented such impacts as loss of the fauna and flora population in lakes and drains within and outside the factory. One of the major problems of cement

industry in the world over is noise generation by various machineries such as grinding mill, fans blowers, compressors and conveyors. The noise levels emitted in cement plants are known to vary from 70 to 118db (decibels). The standard of noise level prescribed for Nigeria's industries are 90 to 115db.it is worthy to know that 90db is the maximum noise level human beings can tolerate. Hence in cement plants the use of ear muffle of various sizes and types are enforced to prevent damage to eardrums. While this is substantially complied with in the cement mill for the workers, the noise level is still above the minimum for the inhabitants of the village. The exposure of man to dust can lead to a wide variety of respiratory diseases. Particles can cause irritation to the eyes, nose and throat. The size of the particles largely determines the scopes of its effects due to ability of being transported. The nature of the particles is also important in determining its health or environmental impacts. Dust can be regarded as fugitive if its source is the cement mill, packing plant, house and road cleaning, while point source dust is generated from kiln stack. Nose masks are provided to cover the nose and mouth while industrial goggles reduce the exposure of eyes to dust particles. It must be noted that this used to constitute a major problem to the community in the past, but with the replacement of the kiln to modern type the incidence of dust pollution has substantially reduced.

Another important problem that results from production process is production of sludge. Sludge is generated in raw mill operation due to mill over feeding and consequent flow back and leakages along the pump line. The sludge is passed through the desilting pit where the particles in the water are allowed to settle before being passed into drains / canal. Water from other sources is also passed out of the factory through the drain canal. Samples of the water is taken regularly and checked for conformity with FEPA standards before being passed out the factory. However empirical investigation reveals that some of the sludge still gets to surface soil thereby polluting topsoil and underground water. Aside from these, Greenhouse gases such as CO2, NO2, CH4, e.t.c are generated through the stack into the environment and as such contribute to the green house effect by increasing the temperature of the earth by trapping ultra violet rays to produce heat. A way of producing CO2 in cement plant is by reducing the quantity of clinker used in cement production and this is achieved by adding such additives as slag, limestone, etc thereby reducing the quantity of linker normally required to produce cement thereby CO2 released into the atmosphere, CH4 quantity released into atmosphere is controlled by ensuring complete combustion of natural gas.

Residents' perception of the environmental impacts of the cement plant operation

Form of pollution: by far the most important environmental problems resulting from the operation of the industry in the perception of residents of Ewekoro, Papalanto and its environs is the dust from air pollution sometimes not only affect visibility but agriculture. Polluting water bodies within the aesthetic nature of the communities and posing a strong threat to the health and wellbeing of the residents.

From Table 2, 11 of the respondents representing 6.40% of the total respondents experience land pollution. 20 of the respondents representing 11.63%of the total respondents experience water pollution while 139 of the respondents representing 80.81% of the total respondents experienced air pollution; and lastly 2 of the respondents representing 1.16% of the total respondents have no specific experience of pollution. From the analysis it is quite obvious that air pollution is the major environmental problem experienced in Ewekoro community. This is not unexpected, being in mind that majority of the respondents live within less than 2km to the factory site and that the cement factory is having noxious effect in Ewekoro as validated by the respondents in the questionnaire administered.

Table 2. Common form of pollution

Form of pollution	Frequency	Percentage
Land pollution	11	6.4
Water pollution	20	11.63
Air pollution	139	80.81
Noise Pollution	2	1.16
Total	172	100

Distance of residence to the cement factory: From investigations conducted, 60 of the respondents lived less than 1km away from the factory, 65 of the respondents representing 37.80% of the total respondents lived 1.2km away from the cement factory, 37 of the respondents representing 21.51% of the total respondents lived 2-3km away from the cement factory, while 10 of the respondents representing 5.14% of the total respondents lived 3km away from the cement factory (Table 3). From the analysis, the majority of the respondents (125) representing 72.68% of the respondents lived within 2km away from the cement factory; this means they are all under the influence of pollution resulting from the operation of the industry.

Table 3. Distance between individual houses and factory

Distance (Kilometer)	Frequency	Percentage
Less than 1	60	34.88
1-2	65	37.89
2-3	37	21.55
Above 3	10	5.68
Total	172	100

From the analysis of the questionnaires, four common diseases were identified as diseases associated with the area (see table 1). 34 of the respondents, representing 19.77% of the total respondents admitted having asthma as a result of the siting of the factory in their location, 19 0f the respondents representing 11.05% of the total respondents admitted having heart disease as a result of the siting of the cement factory in their location. 24 of the respondents representing 13.95% of the total respondents suffer from skin cancer as a result of siting the cement factory in their location, 9 of the respondents representing 5.23% of the total respondents admitted having diarrhea as a result of siting the cement factory in their location while 86 0f the respondents representing 50% of the total respondents admitted not having any of the above named diseases as a result of siting the cement factory in their location.

How residents cope with effects of the pollution

From the questionnaire table 4, 149 of the respondent, representing 86.63% of the total respondents prefer to live with the effects of the pollution, 6 of the respondents representing 3.49% of the total respondents would prefer to migrate to another area, while 13 of the respondents representing 7.56% of the total respondents would prefer to complain to health authorities and lastly, 2 of the respondents representing 1.16% of the total respondents would prefer to take to protest. From the above analysis majority (86.63%) of the respondents would prefer to live with the pollution due to various reasons. It might likely be due to economic reasons and psychological attachment to their area in spite of pollution.

Table 4. How residents cope with the effect of the pollution

Effects of pollution	Frequency	Percentage
Live with it	149	86.63
Migrate to new area	6	3.49
Complain to health authority	13	7.56
Protest	2	1.16
Others specify	2	1.16
Total	172	100

Efforts of the factory in mitigating the effects of pollution

The questionnaire table reveals that 39 of the respondents, representing 22.67% of the total respondents agreed that the factory is doing something to mitigate the effects of pollution. While 121 of the respondents representing 70.35% of the total respondents disagreed.

Lastly, 12 of the respondents representing 6.98% of the group claimed they don't know if the factory is doing anything to mitigate the effects of pollution. From the analysis, majority of the respondents put the blame squarely on the factory management of not doing much to address the pollution problem. From this investigation it is clear that 63.37% of the respondents representing 109 of the respondents believed that nothing will ever be done to compensate them for the pollution while 36.63% of the respondents representing 63 of the respondents believed provision of one social amenity or the other can compensate them for the pollution (Table 5).

Table 5. Development efforts of the industry to compensate for the damage

Development effort	Frequency	Percentage
Providing electricity	18	10.47
Paying compensation	24	13.95
Providing good roads	9	5.23
Providing water supply	12	6.98
Nothing will ever compensate	109	63.37
Total	172	100

Similarly, the analysis revealed that102 of the respondents, representing 59.30% of the total respondents which represent the majority are of the strong opinion that stringent environmental standard should be adopted, while they are strongly against the factory being relocated. This may not be unconnected with the economic benefits the factory is providing them. Response from the worker (outside the factory) and the residents showed that there exist issues bothering on environmental pollution.

All the buildings (residential, workshops, eating houses and the factory itself) roofs and adjoining camp or village houses are thickly dusty. The waste management is in a deplorable condition and there is generally lukewarm attitude towards environmental sanitation.

Table 6. Suggestions of respondents on how to improve community development effort

Community dev. Effort	Frequency	percentage
Relocate the factory	7	4.07
The factory shall be compelled to increase compensation	34	19.77
Adopt stringent environmental standard	102	59.30
I don't know	29	16.86
Total	172	100

Summary and Conclusion

The study has tried to evaluate the negative consequences of Ewekoro cement industry on the environment. The study reveals that though there have been substantial efforts on the part of the management of the industry to reduce their noxious impact, more still needs to be done especially in the area of environmental monitoring so that for example the vibration and other emissions enumerated earlier could be brought under control. From the point of view of an environment management practitioner, the need to significantly and painlessly reduce the volume of carbon dioxide emissions resulting from Portland cement cannot be over-emphasized considering the importance of carbon dioxide in the green house gas effects in global warming. Considering the quantity of carbon dioxide produced per ton of cement, the use of mineral admixtures, which would other wise, be land filled is a must for the environment and for the cement industries. Effort geared toward reclaiming the quarry site should be extended further by actually transforming quarry site into parks and garden for recreational purpose via such projects like afforestation, Scarification and final conversion into animal zoos and garden where people can visit and pay a token that will be used in maintaining such projects. The need for Cement factory authorities to provide the workforce with less irritating means of protecting themselves from dust inhaling and the environment from dust menace by providing super active dust Control equipment is very important. The citing of cement industries should be strictly controlled such that the menace of noise, vibrations, dust, and heavy vehicles movement will be brought under control and far from towns and cities.

Moreover there is the need for the government to intensity effort in the implementation of Environmental impact assessment of cement industries now and in the future considering the nature of its impact on all the facets of human life Aside from that the excavated area should be properly filled to forestall the contamination of groundwater, surface water and aquatic lives, the original state of the excavated area should be attained. Considerable effort must also be geared towards preventing particulates from going into the atmosphere, as its effect in unpredictable in the environment, special devices to arrest and mop up particulates should be provided. Since lots of noise-would be generated as a result of the cement production and mining activities there is the need to find a way of muffing the noise and to shield the site. Moreover large volume of vehicles would be attracted to the cement factory and mining site resulting into soil surface compaction hence there is need to develop appropriate highway and widened to reduce hazards on the environment. Moreover the government the industry and the community should be encouraged to be partners in progress. They can jointly be involved in monitoring environmental resources depletion, especially the compliance level of the plant to minimum standards for sustainable and pollution free society.

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