Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

ENVIRONMENTAL EFFECTS OF CEMENT EXCAVATION IN KALAMBAINA, SOKOTO-NIGERIA

EFEITOS AMBIENTAIS DA ESCAVAÇÃO DE CIMENTO EM KALAMBAINA, SOKOTO-NIGÉRIA

Muhammad Bello Muhammad (PhD)[1]

[1]Department of Sociology, Faculty of Social Sciences, 2346. Usmanu Danfodiyo University Sokoto, Nigeria; Email: muhammad.bello1@udusok.edu.ng

Abstract: The industrialization has generally been regarded as an effective way to provide employment and to improve the socio-economic wellbeing of the people. However, industrial activities can also bring negative impacts on the lives of the affected population. Such is the case in Kalambaina, Sokoto, Nigeria. The government has given license to a company to excavate limestone to make cement and generate revenue. However, the impacts of the activities have been of great concern to Kalambaina inhabitants, especially regarding the emission of cement dust which causes air, water and land pollution. The cement industrial pollution has affected both the physical environment and the quality of the people's lives. This research is about the impacts of the cement industry excavation on the physical environment of Kalambaina community. Data was collected using the face-to-face survey method among 377 respondents who were sampled using the multi-stage sampling technique. Statistical Package for Social Sciences (SPSS) was used for the data analysis. To further support the findings, 10 key informants were interviewed. They were the traditional and religious leaders of the four villages chosen for the study and also, the environmental personnel in Kalambaina community. Functionalist and Common Pool Resources theories were applied during the analysis of the findings. The findings revealed that the respondents are aware that the physical environment has been endangered due to deforestation and the troughs created as result of limestone excavation. Their livelihood has dwindled resulting from poor crop yields and reduced number of herds due to loss of grazing lands. These negative impacts have given rise to social problems such as

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

unemployment, and higher crime rates among the youths as well as homelessness. It can generally be concluded that although the government has granted license to operate the cement industry, cement excavation and pollution has impacted the quality of community lives.

Keywords: Environment, Limestone, Excavation, Degradation, Sustainability.

Resumo: A industrialização tem sido geralmente considerada como uma forma eficaz de gerar emprego e melhorar o bem-estar socioeconômico das pessoas. No entanto, as atividades industriais também podem trazer impactos negativos na vida da população afetada. Tal é o caso em Kalambaina, Sokoto, Nigéria. O governo deu licença a uma empresa para escavar calcário para fazer cimento e gerar receita. No entanto, os impactos das atividades têm sido motivo de grande preocupação para os habitantes de Kalambaina, principalmente no que diz respeito à emissão de pó de cimento que causa poluição do ar, da água e do solo. A poluição industrial do cimento tem afetado tanto o meio físico quanto a qualidade de vida das pessoas. Esta pesquisa é sobre os impactos da escavação da indústria de cimento no ambiente físico da comunidade de Kalambaina. Os dados foram coletados usando o método de pesquisa de campo com 377 entrevistados que foram entrevistados usando a técnica de amostragem em vários estágios. O Statistical Package for the Social Sciences (SPSS) foi utilizado para a análise dos dados. Para apoiar ainda mais os resultados, 10 informantes-chave foram entrevistados. Foram as lideranças tradicionais e religiosas das quatro aldeias escolhidas para o estudo e, também, o pessoal ambiental da comunidade Kalambaina. As teorias Funcionalista e Common Pool Resources foram aplicadas durante a análise dos resultados. Os resultados revelaram que os entrevistados estão cientes de que o ambiente físico está ameaçado devido ao desmatamento e aos vales criados como resultado da escavação de calcário. Seus meios de subsistência diminuíram devido ao baixo rendimento das colheitas e ao número reduzido de rebanhos devido à perda de pastagens. Esses impactos negativos deram origem a problemas sociais, como desemprego e maiores taxas de criminalidade entre os jovens, bem como a falta de moradia. Em geral, pode-se concluir que, embora o governo tenha concedido licença para operar a indústria de cimento, a escavação de cimento e a poluição impactaram a qualidade de vida da comunidade.

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

Palavras-chave: Meio ambiente, Calcário, Escavação, Degradação, Sustentabilidade.

1 Introduction

Industrialization as a process cannot be understood without referring to people living in societies. This is because there is a close connection between people in the society and their environment on the one hand and industries on the other. People exploit their physical environment in order to survive and enhance their lives (Muhammad et al. 2018). Once an industry is established in a place to manufacture certain goods, it generate changes on the socio-economic life of the people living in that area by providing employment and other social amenities. However, the activities of the industries also bring negative changes to the physical environment which affects the sustainable development of the community, such as pollution problems which include air, water and land pollution subsequently causing adverse effects on human and animal health, quantity of crop yields and income as well as other visible physical features on a landscape. These negative changes in turn lower the quality of people's lives in general (Muhammad et al. 2018).

Nigeria like many developing countries in the world is a primary product producer (Muhammad et al. 2018). This is largely because the country is endowed with many natural resources and efforts have been made over the years to tap these resources, mainly for export and foreign exchange which led to the establishment of industries like the Sokoto cement industry. Over the years, the activities of Sokoto cement industry have brought emissions which causes air, water and land pollution leading to environmental pollution which affects the health of the people through the polluted air and sources of water they take (Muhammad et al. 2018). The pollution also causes infertility of the land and affects the quantity of crops produced which then reduces the income of the farmers (Muhammad et al. 2018).

Effects of Cement Excavation to the Environment

There are many ways of permanently changing the land, from soil contamination (pollution by chemicals or waste) to general urbanization (the systematic creation of cities and other human settlements) (Goudie & Viles 2013). Garbage and industrial waste impacts from mining and other forms of industrial pollution, the unwanted consequences of urbanization, and the systematic destruction of soil through over-intensive agriculture; cause long-term land damage, destruction, degradation or loss hence, results to land pollution. As the land is degraded and deserts expand in some places, food production is reduced, water

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

sources dry up and populations are pressured to move to more hospitable areas (Siegel, 2015). Soil erosion is a form of land pollution and degradation - i.e., through the loss of original soil constituents that give the soil its life-supporting capacity.

Picture 1: Limestone quarrying site at Kalambaina Community, Sokoto, Nigeria

Source: author, 2021

The establishment of Sokoto cement industry in 1967 and limestone excavation in Kalambaina community have brought about land degradation and desertification. Cutting down of trees to build the cement industry and excavating limestone in Kalambaina community have created desertification, soil erosion and troughs as seen in the picture above. This has brought about loss of farmlands resulting in less crop yields, loss of houses which can bring about congestion and overcrowding in Kalambaina community.

2 Methods

The survey method was adopted and a sample of 377 respondents was taken to represent the Kalambaina community using a combination of cluster sampling, purposive and systematic sampling

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

techniques. A personal face-to-face structured questionnaire was used to collect the data from the respondents and the analysis was done using Statistical Package for Social Sciences (SPSS). To further support the findings, 10 key informants were interviewed. They were the traditional and religious leaders of the four villages chosen for the study, as well as the health and environmental personnel of the Kalambaina community.

2.1 Location of Study

The general population of the Wamakko Local Government Area is 179,246 (NPC, 2006) consisting of various communities, in which Kalambaina holds a population of 18,320 and Nasarawa Arkilla, 11,110. Kalambaina consists of eight villages (Gidan Gamba, Gidan Bailu, Gidan Maituta, Gantsare, Gidan Baduwa, Girabshi, Gidan Kuka, and Fandirma). Considering the population of the Kalambaina Community in Sokoto State, the size is too large for the researchers to easily manipulate.

Hence, the researchers needed to take a specific sample of the total population. In this regard, 377 respondents were selected and, therefore, served as the respondents of the study. However, four villages were chosen from the eight villages and to ensure that the sample to be drawn is representative of the population in the four villages, 100 respondents were drawn from 150 houses in each village among the Kalambaina community. The target population were males aged 21 and above. The study was more interested in men despite the importance of women or their role in society.

Men have more control over resources, especially material and cultural resources. Men in the Hausa society are also responsible for decision-making and other services in the communities studied. This study involved the use of primary and secondary data sources. The primary source involved collecting data directly from the respondents (the Kalambaina community) using personal face-to-face structured questionnaire. The secondary data sources included official documents from the cement company and other government agencies. The content validity of the instrument was determined by experts in research at the Ministry of Health and Environment, Sokoto, who looked at the technique and coverage of the specific objectives of the study.

The experts recommend the areas to be corrected, and the recommendations were incorporated, which increase the validity. It was tested for validity by pre–testing, through a pilot study carried out twice among

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

120 members of the Nasarawa community. After that, a Cronbach's alpha value of 0.78 was obtained using Statistical Packages for Social Sciences (SPSS) version 23, which signified the instrument's reliability. During this research, a multistage sampling technique was adopted, and a cluster sampling technique was used in dividing the whole area into eight villages and a purposive sampling technique was used in selecting four villages in the community, where each was identified as a cluster.

Within the cluster, a systematic sampling technique was applied in the process of selecting the samples of this research. Each of the four villages of the Kalambaina community constitute of about 150 houses, in which every house selected on each street the head of the household was administered with the questionnaire. The questions in the questionnaire were the same for all respondents and contained open-ended and close-ended questions. The open-ended questions gave the respondents greater flexibility to express themselves with the questions and gave them the freedom to decide the detailed aspects and the length of their answers.

The close-ended questions gave them the chance to choose their answers only from predetermined options. This helped minimize the risk of misinterpretation and permitted easier tabulation and interpretation of data by the researchers. To further support the quantitative data and analysis, ten key informants were interviewed. Two key informants each were interviewed from the four selected villages of the Kalambaina community. The informants were traditional and religious leaders. This was since each village has traditional and religious leaders playing vital roles in the villages.

The remaining two informants interviewed were the environmental and health personnel of the Kalambaina community. They provided us privileged information that cannot be obtainable from other residents. The data collected from the survey was analysed using Statistical Packages for Social Sciences (SPSS) version 23. The data were analysed with the help of frequencies and percentages, which are presented in the form of tables, pie chart and cross tabulations. Most of the respondents were busy and, as such, repeated attempts must be made to make them spare their time and attend to the questionnaire given to them.

This explains why some of the questionnaire could not be retrieved from the respondents up to the compilation level of the study. The return rate was 377 out of the 400 questionnaire distributed. To further support the quantitative analysis. The information collected from the ten key informants interviewed was subjected to qualitative analysis through content analysis. The recorded audio data were sent to an expert

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

transcriber with experience in qualitative studies, conducted in the academic sector, who was accustomed to handling sensitive information with confidentiality. Moreover, the transcriber was provided with background information on the subject before the transcription process to aid understanding and grasp of the subject matter. The transcriber ensured satisfaction with the content, quality and the clarity of the audio recordings.

The conduct of the analysis was done manually by listening to the transcription repeatedly and going over the notes taken during the interview to accustom with the collected data. The produced transcribed word document was crosschecked with the audio outputs to ensure correctness of the transcription. This brought out the thematic views of the respondents through verbatim quotations. Code and sub codes, and matrices were developed to facilitate easy analysis of the qualitative data.

3 Results and Discussion

Limestone excavation have caused environmental degradation in the community, as can be seen from data obtained. Respondents were also asked about the impact of troughs on the community. As shown in Table 1, 186 (91.6%) respondents said that troughs causes loss of more 50% of farm lands in the community while 49 (13.5%) respondents said that troughs causes loss of 40% of their houses in the community and also, 10 (3.0 %) respondents said that troughs are death traps in the community because children in the community cannot play freely due to the fear of falling into the troughs. As observed by the researcher, the topology of the community has changed due to numerous troughs created by limestone excavation which are physically visible.

Table 1: The impact of troughs due to limestone excavation in the community (N=370)

Types of Impact	Frequency	Percent (%)
Loss of farmlands	311	83.5
Loss of houses	49	13.5
Death traps	10	3.0
Total	370	100.0

Source: Field Survey 2021

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

To further show the impacts of activities of Sokoto cement industry on the physical environment, the following responses was obtained from the Key Informant Interviews (KII) conducted with the traditional and religious leaders and the environmental personnel of Kalambaina community.

> *"The activities of the Cement Company have been detrimental to us and of gross social injustice because our farmlands that we inherited have been collected for the excavation of limestone, with little amount of money paid to us" (KI 1)*

> *"Yes of course, troughs are all over the communities depriving us of our farmlands and also our sources of water" (KI 3)*

> *"[...] the activities of the cement company emit cement dust or particles into the air which pollutes and affects the communities" (KI 1)*

> *"The activities of the Cement Company have both advantages and disadvantages but, to a large extent its disadvantages outweigh the advantages" (KI 5)*

> *"Yes, you can see troughs all over which is not good for the environment, the community suffers floods and the cement company has not rendered any assistance whatever. Our lands for farming and housing have been collected for pittance which have force some of the community members to migrate" (KI 2)*

> *"The activities of Sokoto Cement Company in Kalambaina community have not been all smoothe due to the occurrence of pollution…" (KI 9)*

> *"[...] the problems of cement pollution became high over the long period of Cement production and exposure to the emission of Cement dust in the community without the company following environmental laws and social policies" (KI 9)*

> *"[...] the social structure of the community has been affected; most of the lands have been acquired by the Cement Company for limestone excavation, creating troughs which make building new houses and having more farmlands for the community impossible. This affects the families, leading to migration for those who have the option of relocating from the community" (KI 9)*

Both functionalist perspective and common pool resources theory can be used to analyse the impact of the cement industry on the knowledge of the rural people about their physical environment in Kalambaina community.

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

The functionalist perspective can be used to analyse various aspects of the human-environment interaction. The functionalists approach the ecological environment by examining the inter-connections between the various parts composing the ecosystem (Faia 1989). Functionalists see the ecosystem as exhibiting a tendency toward equilibrium; in which its components maintain a delicate balanced relationship with one another. Functionalists stress that our survival depends on our ability to maintain a precarious balance among the living and nonliving components comprising the biosphere (Hughes 1999).

The main concern of the functionalist school of thought is on large-scale social structures and institutions of society, their interrelatedness, interdependence, functions, as well as their constraining effects on actors (Ritzer 2008). Limestone is one of the raw materials for manufacturing cement. The discovery of limestone in Kalambaina community, Sokoto state has facilitated the establishment of Sokoto cement industry which is expected to bring development to the people of the state. In Kalambaina community, the government generates revenue from the cement industry and the cement industry generates profits from the excavation of limestone to produce cement.

This limestone excavation affects Kalambaina community physical environment through deforestation and troughs causing loss of farmlands and houses in the four villages of the community. The environment provides the resources essential for life; these include air, water, land and materials used to create shelter, and other needed products. If human societies exhaust these resources, for example by polluting the air or water supply, the consequences can be dire (Schaefer 2001). Thus, in order to attain relative order and stability, there must be alternative ways of minimizing the extent of deforestation and troughs which have adverse impact on the physical environment and can affect all aspects of human life.

Generally, Common Pool Resources (CPR) are the resources accessible to the whole community which no individual has exclusive use. However, with the introduction of the cement industry in the area, the CPR have been compromised. The cement industry has destroyed the resources of many people through deforestation, limestone excavation, pollution and increased resource scarcity. Kalambaina community share common resources like air, water and land. However, the cement industry uses more of the resources than the community. In return, deforestation and limestone excavation have brought about troughs and land degradation which causes loss of farmlands and homes. This leaves Kalambaina community with the tragedy of land degradation which in turn negatively impact the physical environment of the community.

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

If resource users do not restrain their use of CPR or contribute to CPR management, the result is often the depletion or degradation of the CPR's quality. People can avert these tragedies and sustaining CPRs by working together to address them, and what makes the rules or institutions that people devise in managing CPRs successful. Examples of institutional responses include resource privatization or private property rights, government management, and community management through collective action, among others (Gardner, et al., 1990).

Reaction to the Impact of Cement Pollution

As shown in Table 2, majority of the respondents, that is 357 (96.5%) respondents said that the villagers did not protest against the effects of Cement Pollution in the community. This is because their leaders always suppress any form of protest by cautioning them on the negative consequences of protest. Thus, giving them hope that measures will be taken by the cement industry to curtail the impact of cement pollution on the community. The 13 (3.5%) respondents that protested by carrying signpost and blockading the road leading to the cement industry in order to bring the attention of the government and the managers of the cement industry were arrested by police. And later released on bail after signing an agreement not to cause any unrest again.

Table 2: Protest the impact of cement pollution in the community (N=370)

Responses	Frequency	Percent (%)
No	357	96.5
Yes	13	3.5
Total	370	100.0

Source: Survey Field 2021

As shown in Table 3, 324 (93.5%) respondents said that community leaders suppress villagers from protesting against the impact of cement pollution in the community. A total of 33 (6.5%) respondents said that the fear of security agencies prevented the villagers from protesting. This shows that the majority of the respondents said that the villagers did not protest against the impact of cement pollution in the community because their leaders prevented them from doing so.

Table 3: Reasons for not protesting the impact of cement pollution in the community (N=357)

Reasons	Frequency	Percent (%)
Community leaders suppress protest	324	93.5

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

Fear of security agencies	33	6.5
Total	357	100.0

Source: Field Survey 2021

4 Conclusion

It is important to note that the people of the Kalambaina community have been suffering for a long period of time, with no intervention from either the government or the cement industry. The inhabitants of these villages have lost most of their farmlands and homes to limestone excavation by the cement industry resulting in poor crop yields and deforestation, which is the contribution of the study scientifically. The community leaders have suppressed any form of protest.

These have affected the community negatively which needs intervention from both the government and the management of the cement industry.

Proper environmental laws and social policies must be implemented by both the government and the cement industry to curb this menace and enhance environmental sustainability, thus, bringing about meaningful development to the community, which is the contribution of the study publicly. These will be sine-qua-non to the social injustices experienced by the rural people of the Kalambaina community.

References

Epa.gov. 2014. http://www.epa.gov/ebtpages/airpollutants.html. [14 October 2017].

Faia, M.A. (1989). Culture Materialism in the Functionalist Mode. *American Sociological Review* 54: 658-660.

FEPA. (1999). *National Master Plan for Public Awareness on Environment and Natural ResourcesConservation in Nigeria*, FEPA, Garki, Abuja.

Gardner, Roy, Elinor Ostrom, and James M. Walker. (1990). The nature of common-pool resourceproblems. *Rationality and Society* 2.3: 335–358.

Goudie, A. S., & Viles, H. A. (2013). The earth transformed: an introduction to human impacts on theenvironment. *John Wiley & Sons*.

Growing Populations-Tactics to Mitigate or Suppress them. In countering 21st century social-environmental threats to growing global populations. 85-119. *Springer, Cham*.

Revista Verde
Green Journal
ISSN: 2764-9024 DOI: 10.5281/zenodo.7827979

Hughes, R.N. (1989). A Functional Biology of Clonal Animals. *Chapman & Hall*, London.

Muhammad, M. B., Rahimah, A. & Vivien W.C.Y. (2018). Socio-economic effects of industrialization inthe society. *International Journal of Environment, Ecology, Family and Urban Studies* (IJEEFUS) 8(4):IJEEFUSAUG20183.

Muhammad, M.B., Rahimah, A. & Vivien W.C.Y. (2018). The effects of air pollution on socio-economicactivities in Sokoto State, Nigeria. *International Journal of Engineering and Technology*.

NPC. (2006). *Population and Housing Census*. Abuja, Nigeria.

Ritzer, G. (2008). *Contemporary Sociological Theory and its Roots*: The Basics. New York: McGraw.

Hill.Schaefer, R.T. (2001). *Sociology*. Edisi ke-7. New York: MC Graw-Hill.

Siegel, F. R. (2015). Global perils that reduce the earth's capacity to sustain and safeguard growing populations—tactics to mitigate or suppress them. *Countering 21st Century Social-Environmental Threats to Growing Global Populations*, 85-119.