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Managing the Environment with Limited Knowledge in Nigeria: A Study of Environmental Workers in Enugu State

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Abstract. Given the importance of environmental management to human survival, this study sought to investigate the extent to which environmental workers in Enugu State, Nigeria, would be knowledgeable about environmental protocols, conventions and laws governing the management of the environment in the light of how highly educationally qualified they are and how much domestication of the international environmental protocols, conventions and laws has been carried out by the government at the national and local levels. The population of the study consisted of five hundred and seven (507) randomly selected participants who are environmental workers working for the state government. The research instrument was a self-administered questionnaire with a reliability coefficient (Cronbach alpha) of .81 and .85. The study employed a cross-sectional survey design and, the stratified random sampling proportionate to size was adopted in selecting respondents for the study. The data from the fieldwork were analyzed using the Statistical Package for Social Sciences (SPSS, version 20). Descriptive statistics and Chi-Square goodness of fit analyses were employed in description and inferences. From the findings, the study concludes that a statistically significant proportion of environmental workers in Enugu State possess moderate level knowledge of environmental protocols and conventions (χ2= 174.3; df = 2; p-value = 0.00; χ2= 311.9; df = 2; p-value = 0.000). The findings have implications for government policy concerning environmental management especially as it has to do with environmental degradation and climate change as well as the framework for environmental protection which derives from the domestication of most of the relevant international environmental protection laws.

Keywords: climate change, environmental laws, environmental management, environmental workers, knowledge, Nigeria

Introduction

The environment is indispensable to human survival on earth. That is why negative conditions of the environment such as degradation and climate change impact tremendously on human health and the survivability of the planet. Environmental degradation has such a negative impact on human health that many scholars have paid serious scholarly attention to those debilitating biological consequences for human health that result from negative states of the environment (Carson, 1962; Sena, 2006).

The African continent is among the continents that are most vulnerable to several diseases resulting from a poorly managed climate condition. Such diseases include but are not limited to malaria, tuberculosis, and diarrhea (Guernier, Hochberg & Guegan, 2004). Also in this regard, for example, is the issue of rising temperatures because of climate change leading to the changing of the geographical distribution of diseases by vectors because the vectors then migrate to new areas with higher altitudes. This can be seen in the migration of the malaria-causing mosquitoes to higher altitudes which exposes large numbers of hitherto unexposed people to infection (Boko et al., 2007).

Scholars have severally held that environmental degradation and climate change have severe impacts on the environment in terms of desertification, drought, temperature rise, low agriculture yield, drying up of water bodies, and flooding, among others (Lybbert & Sumner,

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2012; Nederlof, Wennink, & Heemskerk, 2010; Oruonye, 2011; Simpson & Burpee, 2014). In this regard, the UN Framework Convention on Climate Change (United Nations Environmental Programme, 2007) declares that agricultural production that relies mainly on rainfall for irrigation will be adversely affected in many African countries, especially for subsistence farmers in Africa, south of the Sahara. Also, billions of people in more than 100 countries globally were periodically exposed to climate change-induced extreme weather events such as earthquakes, tropical cyclones, flood, or drought, and more than 184 deaths per day are recorded in different parts of the world, with 11 percent of the people exposed to natural hazards living in the developing countries (Sena, 2006).

With the foregoing scenario, one of the least things a state could do to give the people a fighting chance against environmentally induced suffering and even deaths would be to have the right kind of environmental workforce. For such a workforce there is a need for properly educating them and making them very knowledgeable on how to manage and govern when it comes to issues about the environment. If countries or states' environmental workforce end up or turn out not to be properly educated about the environment and environmental issues, that would put an unimaginable number of human lives at risk.

This foregoing could result in what Selznick (1948; 1949) calls "the recalcitrance of the tools of action" – a situation where formal organizations such as agencies and bureaucracies that are used by governments to actualize objectives such as those of environmental management are inescapably committed to the mediation of human structures which even though they are indispensable to the actualization of such goals end up frustrating the actualization of the same goals because of "recalcitrance", which in ordinary language could just mean unsuitability arising from some levels of personal inadequacy or commitment to other interests hence leading to inefficiency and therefore ineffectiveness in a bureaucratic system or government agency. To prevent a situation of the recalcitrance of the tools of action, knowledge amongst those who could be regarded as the tools of action is essential. Knowledge has been conceptualized by Arukwe (2014) as follows:

> *we can begin on the assumption that knowledge has the basic dimensions of the society and the individual, as a human being gains knowledge either because other persons have caused the individual to cognize it or because the individual has acquired knowledge relying virtually exclusively on personal inductive or deductive ability… Beyond the basic dimensions of knowledge, knowledge has the further dimensions of being colonial (including neo-colonial) or postcolonial.*

However, to determine the levels and forms of knowledge that people who work in settings that deal with the environment possess there have been several studies by diverse bodies including agencies, associations, professional bodies as well as academics and researchers to determine the levels, sources, and types of knowledge people have about the environment and such important environmental topics like climate change. These diverse studies on knowledge about the environment and climate change have expectedly yielded a large corpus of bodies of research data and information on the knowledge that people possess both as individuals and groups concerning the environment and climate change. We would briefly present some of the findings of these previous studies in sequence hereunder.

Research conducted by the European Commission on European attitudes toward climate change via Eurobarometer surveys, an online platform that conducts surveys on several important issues relating to Europeans revealed that more than half of Europeans feel very well or fairly well informed about different aspects of climate change; 56% respectively confirm that they are well informed about both the causes and the consequences of climate change, whereas 52% report that they feel very well or fairly well informed about the ways of fighting it. Also, citizens from Sweden, the Netherlands, and Finland feel the best informed about issues

related to climate change while the lowest levels of (subjective) information can be found among Bulgarians, Romanians, Portuguese, and Turkish citizens (Eurobarometer, 2009).

The same European Commission's (Eurobarometer, 2009) survey also studies Europeans' knowledge and perception about the impact of CO2 emission on climate change and found that the majority of Europeans (55%) disagree that the impact of CO2 emissions on climate change is only marginal, 30% think that CO2 emissions only have a marginal impact and 12% confirm they do not know. Furthermore, Hungarians, Slovaks, and Greeks most frequently disagree with the statement that CO2 emissions only have a marginal impact and are thus most likely to think that CO2 emission has a more than a marginal effect on climate change. Whereas Irish, Dutch, Estonian, and British respondents are conversely convinced that emissions of CO2 only have a marginal impact on climate change.

The Caribbean Institute of Media and Communication (2012) likewise carried out a survey on climate change knowledge, attitude, and behavioural practice among people in the Caribbean region of the world with a particular focus on Jamaican citizens. The study adopted a mix of quantitative and qualitative methods. Thus, a national survey of Jamaican households, which collected data from 1484 respondents and an online version of this survey, which had 503 persons completing the survey found that most persons (82.6%) have heard the term "climate change" while; about 56.4% of respondents said that climate change was that variation in global climate, temperature, and weather patterns. The study would also reveal that about half (49.5%) of the respondents were very concerned about climate change with another 31.2% being moderately concerned; 14.1% were not concerned at all, and many persons were either "very interested" (60.0%) or "somewhat interested" (30.2%) in finding out more about the effect of climate change in Jamaica.

Abegaz and Wims (2014) working on the knowledge of officials who work in environment-related industries and organizations including government departments conducted a study on extension agents' awareness of climate change in Addis Ababa, Ethiopia. The sample was selected from extension agents who had two years or more of work experience as Extension Agents. The design of their study was a survey design and questionnaires were used as the means of data gathering. The questionnaires would be administrated to a total of 60 Extension Agents, which translates to 15 Extension Agents from each of the four districts of Ethiopia. Their findings show that the majority of the respondents (91.5%) agreed that climate change has or will have an impact on the agricultural sector.

Sah, Bellad, and Angolkar (2015) conducted research using a cross-sectional survey in three high schools of Belagavi city, Karnataka, India between February 2014, and October 2014 with a Sample size of 400 students randomly selected from 3 high schools from 8^{th}, 9^{th}, and 10^{th} class respectively. The study shows that school (57.34%) was the major source of information regarding global warming followed by the media (36.57%) and friends and family (6.09%). The study found that there was a statistically significant difference in the level of attitude of students towards global warming according to their age, sex, class, and different medium of school ($p<0.05$).

In the Czech Republic, Skalík (2015) also conducted a study on climate change awareness and the attitudes of adolescents and concluded that the respondents who viewed climate change as definitely a positive phenomenon scored on average 4.1 questions out of a possible 12, while respondents with a perceptibly negative perception of climate change recorded a correct answer on average to 5.7 questions.

In Nigeria, Luka and Yahaya (2012) conducted a study to determine the sources of awareness of climate change and knowledge of the effects of climate change among sesame producers in the southern agricultural zone of Nasarawa State, Nigeria. They aimed to ascertain the knowledge held among sesame producers of the effects of climate change since these sesame producers had been working with government-funded extension agents. The findings

of Luka and Yahaya revealed that increased rains, insect infestation, and torrential downpours were perceived by the sesame producers as effects of climate change.

Similarly, a quantitative study on fish farmers' knowledge on climate change impact on fish production in the Delta State of Nigeria by Aphunu and Nwabeze (2013). Nwabeze employed a random sample of 80 respondents found that 75% of the respondents were aware of climate change impacts on their fish farming activities and their lives while nearly 77% of respondents know little or nothing about climate change and its impacts. According to the researchers, the main source of information on climate change was found to be personal experience (33.8%), followed by Radio/Television (21.3%) and friends/neighbours (18.8%).

In Anambra State, Nigeria, Iwuchukwu, and Onyeme (2012) researched Knowledge of climate change among extension workers of the Agricultural Development Programme (ADP). The study used a total of 70 respondents purposively selected from four agricultural zones in the state were used for the study. The result of the study revealed Male extension workers sourced information on climate change mainly from radio (100%), newspaper (95%), and television (80%) while the female extension workers sourced mainly from radio (90%), fellow extension workers (85%) and friends/relations (70%).

Ayawunyi (2013) likewise researched the extension service strategies in adaptation to climate change. The result of the study indicates the following strategies effective in adapting to climate change: enterprise choice (100%) Conservation agricultural practices (95.8%) early warning systems (92.7%) use of crops residues (91.7%) passing new farming techniques to the farmers and making the farmers willing to adopt (90.6%) water harvesting holes (88.5%) initiation of activities that counteract climate change impact via afforestation (87.6%) promoting new crop varieties that are droughts resistance (86.5%). This implies that most of the adaptation strategies adopted by the respondents were effective for cushioning the impacts of climate change in the study area of Oyo State, Nigeria.

In the Enugu State of Nigeria, which has had a larger burden of environmental degradation and climate change than some of the surrounding states, a study was carried out by Agu, Ekpo, and Ajator (2015). Their study was aimed to assess the key vulnerability sectors and adaptation strategies to climate change using different Participatory Research Approaches (PRA) methods. The PRA included an in-depth interview, focus group discussion and structured questionnaire found that 62.5% of the respondents did not have any knowledge of climate change, 53.8% did not know the causes of climate change and 66.2% of the respondents could not identify the effect of climate change on their livelihood activities.

Similarly, Arukwe, Offor, and Chime (2020) have quantitatively investigated the nature of the knowledge and attitudes of environmental workers on environmental degradation and climate change in Enugu State given the high burden of environmental degradation and climate change faced by the state. Environmental workers in this study were operationalized as all the staff in Enugu State ministries/parastatals, whose job descriptions relate directly to the management of the environment. The study found that a statistically significant proportion of environmental workers in Enugu State possess a high level of knowledge of environmental degradation and climate change ($\chi 2 = (2, N=507) = 84.07$, $p = 0.001$). The research also found that there is a statistically significant difference in the attitudes of environmental workers towards environmental degradation ($t = (506, N=507) = 32.26$, $p = .001$). Despite the high level of self-reported knowledge shown by the Environmental workers, there was a statistically significant difference in their attitudes towards environmental degradation, thereby underscoring the need for further research to isolate the several areas of variation in attitude to environmental degradation but also an urgent policy on environmental workers' continuing education and reorientation.

Also, a different study by Arukwe and Offor (2020) examined the factors affecting the knowledge and attitudes on environmental degradation and climate change among

environmental workers in Enugu State. Participants were selected via a stratified random sampling procedure to make the sampling process more efficient given the layered nature of the target population. The findings showed that age (r = .09, p = .01) is associated with Environmental workers' knowledge and attitude to environmental degradation and climate change, while educational attainment significantly predicted knowledge of environmental degradation and climate change (β = -.20, t (505) = -4.66, p = 0.00), However, the job status was found to not correlate with environmental workers' attitude to environmental degradation and climate change (r = -0.06, p = .07). Implications of the findings include that environmental degradation and climate change policy formulation would benefit from this study especially, in environmental education for environmental workers.

Given what is already known about environmental workers in Enugu State the present study investigated whether a significant proportion of environmental workers in Enugu State would be highly knowledgeable about environmental protocols, conventions, and laws or not given how highly educationally qualified they are and how much domestication of the international environmental protocols, conventions and laws has been carried out by the government at the national and local levels. As Ele (2016) and Arukwe and Offor (2020) have reported Nigeria has the legal policy framework for environmental protection which derives from the domestication of most of the relevant international environmental protection laws.

Methods

Participants

The population of this study comprised of all the staff in Enugu State ministries/parastatals, whose job descriptions related directly to the management of the environment on behalf of the state and who are capable, therefore, by their neglect of duty or inability to carry out their work effectively, of engendering negative environmental outcomes. The ministries/parastatals are the Ministries of Environment, Agriculture, Housing Development Corporation, Waste Management Authority, and Forestry Commission. Moreover, the incorporation of these ministries was to enable the researchers to obtain a broad spectrum of cross-sectional data. The sample was made up of five hundred and seven (507) randomly selected participants that were administered with the study questionnaire. The participants were 50.5% male and 49.5% female, their age range was 20 years to 60 years and above, and they were mostly B.Sc./HND degree holders.

Instruments

Data collection mainly utilized a self-administered questionnaire. The quantitative instrument was a 40-item questionnaire instrument designed by the researchers. The questionnaire instrument was designed to measure environmental workers' knowledge of environmental protocols, conventions, and laws. The questionnaire instrument consists of three segments. The first segment is the respondents' demographics, which captures the respondents' demographical data. The rest of the segments are on knowledge and measure the respondents' level of knowledge on environmental degradation and climate change.

Face, construct and content validity for the questionnaire and in-depth interview guide were achieved through engaging three senior academics from the social sciences faculty of the University of Nigeria, who are experienced in research methodology, to validate the instrument. The reliability coefficient (Cronbach alpha) of .81 and .85 were obtained for the instrument. The instrument had a test-retest reliability coefficient of .73. The data collected from the questionnaire instrument were analyzed using the Statistical Package for the Social Sciences (SPSS, version 20).

Procedure

This study adopted an exploratory cross-sectional survey design. The study employed probability sampling. Specifically, stratified random sampling proportionate to size was adopted in selecting respondents for the study. A stratified random sampling method was adopted to make the sampling process more efficient given the layered nature of the target population. It was adopted also because a sampling frame exists for the study population which makes the adoption of a stratified random sampling strategy possible. The sample size for this study was selected based on the several proportions of numerical strengths of staff of the following ministries and parastatals: Enugu State Ministry of Environment and Mineral Resources, Enugu State Ministry of Agriculture and Natural Resources, Enugu State Forestry Commission, Enugu State Ministry of Transport, Enugu State Waste Management Authority, and Enugu State Housing Development Corporation.

Ethical Considerations

Given the involvement of human participants in this study, ethical clearance to embark on the study was sought and obtained at two levels. The first level was at the unit or departmental level where the proposal and application for the study were submitted to the postgraduate research committee of the Department of Sociology and Anthropology, University of Nigeria, Nsukka. The committee initially evaluated, vetted, and approved the study for the fieldwork stage. Further, ethical approval was sought for the study at the institution (university) wide level. At this level, the proposal and application for the study were submitted to the University of Nigeria Human Experimentation Ethics Committee (HEEC), whose responsibility is to moderate and approve all research in the University involving human participants. It was after the approval was eventually obtained from the HEEC that the researchers mobilized and moved to the field for the fieldwork phase of the study.

During the fieldwork, we took out time before the actual enrolment of each participant to explain the objectives of the study to the participant. We informed each participant of their right to refuse enrolment into the study or to drop out from the study at any period that they no longer feel like continuing with the study. We assured each participant that there would be no harm that could come to them from participating in the study and that the data we generate from the study will be kept strictly confidential and when it gets published there will be no possibility of anybody being able to know who the participants were individually or being able to associate any of the participants with responses or opinions that they express during the study. We carefully explained to the participants that the study would be purely for academic purposes. If the participant agrees with the explanations provided, we proceeded to ask such participant to sign the informed consent form. Otherwise, the participant dropped out while we continued sampling from the target population to achieve the desired number of study participants. In all, the enrolment procedure into the study and indeed every other aspect of the study were operated per the Helsinki Declaration on studies involving human participants (see Arukwe & Okwara, 2020; Declaration of Helsinki, 2001).

Data Analysis

All the completed questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS, version 20). Descriptive statistics such as percentages, graphs, and charts were used in analyzing the responses to the questionnaire items while Chi-Square goodness-of-fit analysis was adopted to test the research hypotheses.

Results

The respondents were asked to indicate their sex and they were captured in two categories both male and female grouped in the table below.

Table 1. Sex distribution of respondents

Sex of Respondents	Frequency	Percentages (%)
Male	256	50.5
Female	251	49.5
Total	**507**	**100.0**

The results in Table 1 show the distribution of male and female respondents in this study. The table indicates that 50.5% of the respondents were males whereas 49.5% of the participants were females. This implies that the male respondents were slightly higher than the female respondents.

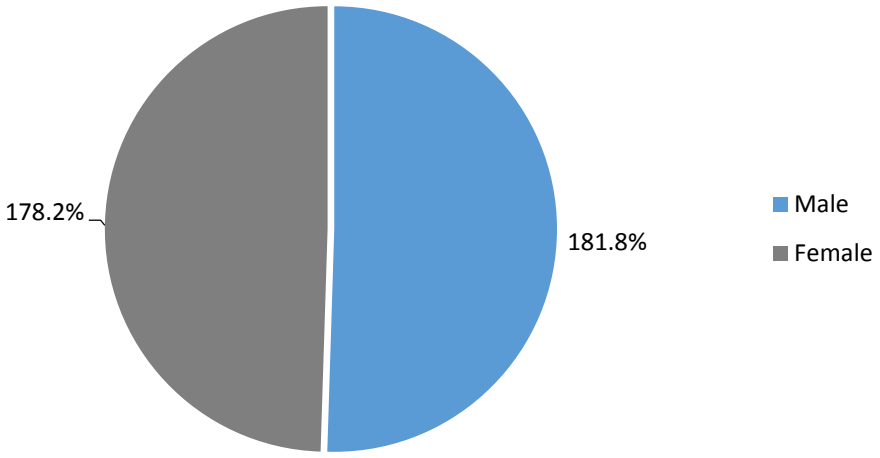

Figure 1. Respondents by their sex

Figure 1 presents the percentages from the frequency distribution, which were further illustrated through a pie chart. The pie-chart shows graphically that males were slightly more, numerically than the females.

Table 2 presents the respondents' level of education. The responses range as follows: no formal education, FSL, SSCE, OND, B.Sc./HND, M.Sc., and Ph.D.

Table 2. Level of education of respondents

Education	Frequency	Percentages (%)
No formal education	4	.8
FSL	13	2.6
SSCE	52	10.3
OND	75	14.8
B.Sc./HND	282	55.6
M.Sc.	79	15.6
PhD	2	.4
Total	**507**	**100**

The results of Table 2 show that .8% of the respondents had no formal educational qualification, 2.6% of the respondents had FSL as their educational qualification, 10.3% of the respondents had SSCE as their highest educational qualification, 14.8% of the respondents had OND as their highest educational qualification, 55.6% of the respondents had B.Sc./HND as their highest educational attainment, 15.6% of the respondents had M.Sc. as their highest

educational attainment while .4% of the respondents had Ph.D. as their highest educational qualification. This reveals that the majority of the respondents were B.Sc./HND holders. It is evident by the table that most of the respondents were literate enough to respond to the questionnaires.

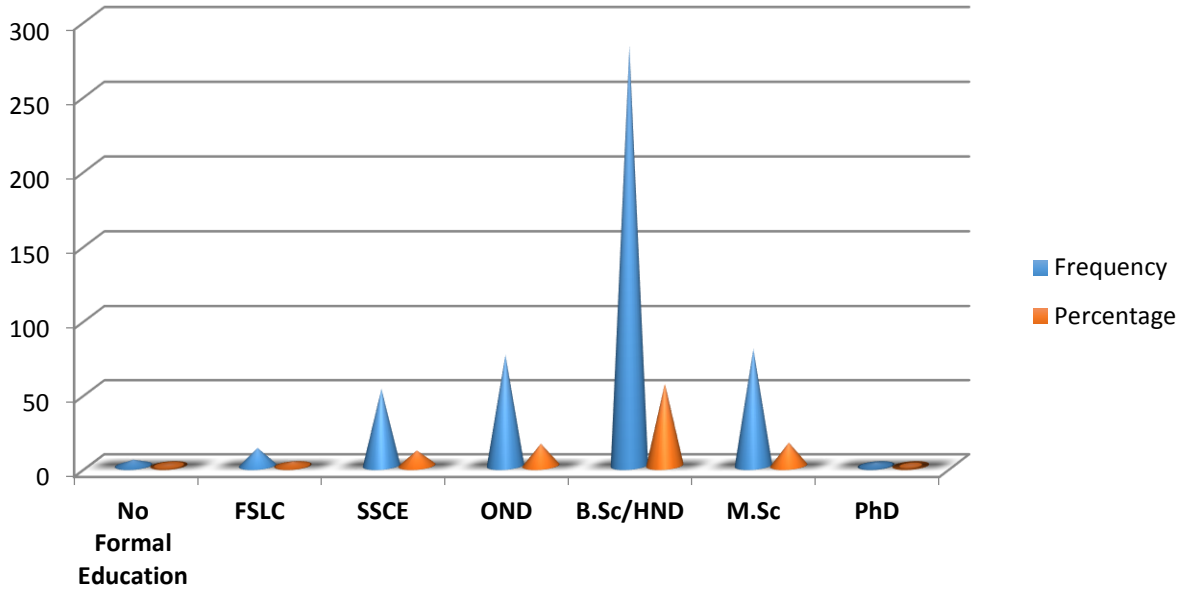

Figure 2. Respondents by their educational attainment

Figure 2 is aimed at graphically demonstrating the educational attainment of the respondents and it shows that majority of the respondents have B.Sc./HND as their highest educational attainment.

Table 3 presents the frequency distributions of the work rank or the grade level of the respondents, which is grouped into 3-7, 8-13, 14-16.

Table 3. Distribution of respondents by grade level

Grade Level	Frequency	Percentages (%)
3-7	163	32.1
8-13	271	53.5
14-16	73	14.4
Total	**507**	**100.0**

The results in Table 3 show that 32.1% of the respondents were within the grade level range of 3-7, then 53.5% of the respondents were within the grade level 8-13 while 14.4% of the respondents were within the grade level 14-16. This implies that most of the respondents were within the grade level 8-13.

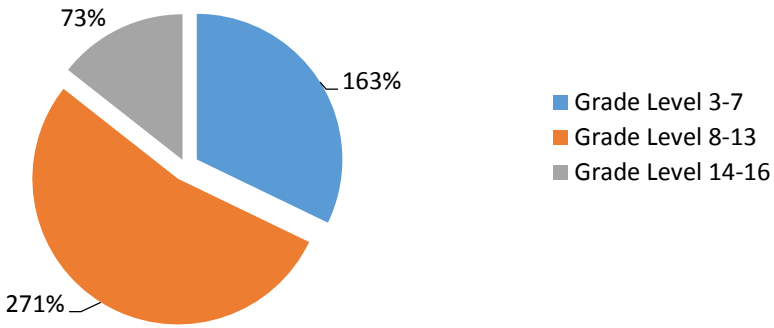

Figure 3. Respondents by their grade level

Figure 3 is aimed at graphically illustrating the respondents' grade level. The pie chart shows that majority of respondents are those within the grade level 8-13 and followed by those within grade level 3-7.

Hypothesis Test

The study hypothesized that a significant proportion of environmental workers in Enugu State would possess neither low nor moderate knowledge but be highly knowledgeable about environmental protocols, conventions, and laws. In testing the above hypothesis, the data were first summed up to obtain the extent to which environmental workers know about environmental protocols, conventions, and environmental laws in Nigeria. Secondly, the range of the summation was calculated and divided by three to obtain the boundary of each class. Thirdly, the scores were re-coded into three parts (High, Moderate and Low) to represent the three classes obtained from dividing the range in step two above. Chi-square goodness-of-fit was used to analyze whether the environmental workers' level of knowledge was uniformly distributed at a 0.05 significance level.

Table 4. Chi-Square contingency table of respondents' knowledge of environmental protocols and conventions

P Knowledge of Environmental Protocols and Conventions	**Observed N**	**Expected N**	**Residual**
Low	75	169.0	-94.0
Moderate	306	169.0	137.0
High	126	169.0	-43.0
Total	**507**		

Note: χ^2= 174.3; df = 2; *p*-value = 0.00

Table 4 presents Chi-Square goodness of fit analysis for a significant proportion of Environmental Workers in Enugu State who would be highly knowledgeable about environmental protocols and conventions. It shows that a total of 306 environmental workers possessed moderate knowledge of environmental protocols and conventions indicating a residual of 137.0 above the expected distribution. Also given that the obtained *p*-value (0.00) is less than 0.05 at a chi-square value of 174.3 and degree of freedom 2, the null hypothesis is rejected. The study, therefore, concludes that a statistically significant proportion of Environmental Workers in Enugu State possess moderate level knowledge of environmental protocols and conventions.

Table 5. Chi-Square contingency table of respondents' knowledge of environmental laws in Nigeria

Knowledge of Environmental Protocols and Conventions	Observed N	Expected N	Residual
Low	87	169.0	-82.0
Moderate	356	169.0	187.0
High	64	169.0	-105.0
Total	**507**		

Note: χ^2= 311.9; df = 2; *p*-value = 0.000

Table 5 presents Chi-Square goodness of fit analysis for a significant proportion of Environmental Workers in Enugu State who would be highly knowledgeable about environmental laws in Nigeria. It shows that a total of 356 environmental workers possessed moderate knowledge of environmental laws in Nigeria indicating a residual of 187.0 above the expected distribution. Also given that the obtained *p*-value (0.00) is less than 0.05 at a chi-square value of 311.9 and degree of freedom 2, the null hypothesis is rejected, and the alternative hypothesis is accepted. The study, therefore, concludes that a statistically significant proportion of Environmental Workers in Enugu State possess moderate level knowledge of environmental protocols and conventions.

Discussion of Findings

Based on the findings from the study, male environmental workers are slightly higher in number than their female counterparts. The study also revealed that those with a university or polytechnique higher education degree (B.Sc./HND) as their reported level of educational attainment are in the overwhelming majority showing that a preponderance of the respondents has the good educational background to work in the environmental agencies as well as to participate in this study. The study equally revealed that the majority of the respondents are within grade levels 8-13. This is the intermediate rank level for workers in the civil service and those within this category range from senior managers within the agencies to medium level managers. Therefore, most of the survey participants come from educated middle to senior managerial positions within the environmental protection agencies and ministries.

The data and hypothesis test leads the study to conclude that a statistically significant proportion of the environmental workers in Enugu State possess moderate level knowledge of environmental protocols and conventions. This finding is interesting given that the study participants were made up of mostly highly educated senior to middle-level managerial categories of environmental workers. A finding of this nature has far reached implications for the efficiency and effectiveness of discharge of the duties of these officials regarding protecting and conserving the environment as well as the implementation of the environmental protocols, conventions, and laws. It is instructive that some of the materials that the environmental workers were tested with to ascertain their knowledge are from the legal policy framework for environmental protection which derives from Nigeria's domestication of international environmental protection laws (see Ele 2016; Arukwe & Offor 2020). That the environmental workers did not have high knowledge about these protocols says a lot about their capability to manage the environment effectively. It also raises serious concern and an urgent need for the government to intervene with policies that would privilege the retraining of most of these environmental managers. The present study corroborates the work done by Arukwe, Offor, and Chime (2010) who found that despite the high level of self-reported knowledge shown by the environmental workers there was yet a statistically significant difference in their attitudes towards environmental degradation, thereby underscoring the need for further research to

isolate the several areas of variation in their attitudes as well as an urgent policy on environmental workers' continuing education and reorientation

On the other hand, the finding contrasts with some of the previous studies on similar issues. For example, Abegaz and Wims' (2014) study on the knowledge of environmental officials in Ethiopia reported a 91.5% knowledge score for the Extension officials regarding the impact of climate change. Similarly, Iwuchukwu and Onyeme (2012) reported very high levels of attempts to source information and acquire knowledge on climate change among extension workers of the Agricultural Development Programme in the neighbouring Anambra State. Also, Ayawunyi's (2013) study on the extension service strategies disseminated to farmers for adaptation to climate change indicates the high level of knowledge possessed by the extension agents, which led to the results of successfully cushioning the impacts of climate change in Oyo State, Nigeria, and an indication of the success of their knowledge-driven strategies for effective adaptation to climate change.

Part of the implications for the findings of this study is the spectre of the occurrence of Selznick's (1948; 1949) "recalcitrance of the tools of action" in the agencies and bureaucracies that manage the environment in Enugu State. Environmental workers are agencies and bureaucracies charged by governments with the responsibility of actualizing the objective of efficient and effective management of the environment. If they, because of their low to moderate level of knowledge on how to manage the environment, are unable to actualize the goals they are charged with and end up frustrating the actualization of the goals because of "recalcitrance", then they would be proving the vitality of Selznick's thesis. To prevent a situation of the recalcitrance of the tools of action, the right knowledge of environmental management amongst those who could be regarded as the tools of action in this instance environmental workers in Nigeria generally and in Enugu State is essential.

Conclusion

The survival of the human species on earth is dependent on how the environment is managed, going into the future. Consequently, those who manage the environment are an essential part of the survival plan of humanity; hence the need for careful consideration of the type and level of knowledge possessed by these categories of people. It is against this backdrop that this study sought to investigate the extent to which environmental workers in Enugu State, Nigeria, would be highly knowledgeable or not about environmental protocols, conventions and laws governing the management of the environment.

The study concludes that a statistically significant proportion of the environmental workers in Enugu State, who are otherwise highly educated workers, possess only moderate levels of knowledge of the environmental protocols, conventions, and laws. This has implications for the efficiency and effectiveness of discharge of the duties of these officials regarding protecting and conserving the environment as well as the implementation of the environmental protocols, conventions, and laws. One of the implications of the finding is that it revitalizes Selznick's (1948; 1949) "recalcitrance of the tools of action" thesis. As a result, the finding calls for a radical re-education and reorientation of environmental workers in Nigeria to provide them with the right knowledge to facilitate the efficient and effective management of the environment.

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Conflict of Interest

The authors report no conflicting interest concerning the research, authorship, and/or publication of this article.

References

Abegaz, D. M., & Wims, P. (2014). Extension Agents' Awareness of Climate Change in Ethiopia. *The Journal of Agricultural Education and Extension*, *21*(5), 479–495. https://doi.org/10.1080/1389224x.2014.946936

Agu, N. N., Ekpo, F. E., & Ajator, U. O. (2015). Assessment of key vulnerability sectors and adaptation strategies to climate change in Enugu State, Nigeria. *Swift Journal of Research in Environmental Studies*, *1*(01), 001–007.

Aphunu, A., & Nwabeze, G. (2013). Fish Farmers' Perception of Climate change impact on fish production in Delta State, Nigeria. *Journal of Agricultural Extension*, *16*(2). https://doi.org/10.4314/jae. v16i2.1

Arukwe, N. O. (2014). Teaching Emancipatory Postcolonial Knowledge. *Journal of Black Studies*, *45*(3), 180–204. https://doi.org/10.1177/0021934714528706

Arukwe, N. O., & Offor, C. R. (2020). Factors affecting environmental workers' knowledge and attitudes on environmental degradation and climate change in Enugu State. *Nigerian Journal of Psychological Research*, *16*(2), 96–104.

Arukwe, N. O., Offor, C. R., & Chime, S. C. (2020). Knowledge and attitudes on environmental degradation and climate change among environmental workers in Enugu State. *Journal of Environmental Management and Safety*, *11*(2), 41–54.

Arukwe, N. O. & Okwara, F. O. (2020). Using mixed methods to mend methodological flaws in the analyses of Traditional Birth Attendants' effectiveness in health service delivery: An examination of management of pregnancy complications. *Sage research methods cases*. London: Sage Publications Ltd. DOI: https://dx.doi.org/10.4135/9781529732221

Ayanwuyi, E. (2013). Extension services strategies in adaptation to climate change in Oyo State, Nigeria. *Civil and Environmental Research*, *3*(7), 115–120.

Boko, M., Niang, I., Nyong, A., Vogel, C., Githeko, A., Medany, M. B., Osman-Elasha, B., Tabo, R., & Yanda, P. (2007). Climate Change: Impacts, Adaptation and Vulnerability. In M. Parry, O. Canziani, J. Palutikof, P. Van Der Linden, & C. Hanson (Eds.), *Working Group II Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 433–467). Cambridge: Cambridge University Press.

Caribbean Institute of Media and Communication. (2012). *Report on climate change knowledge, attitude and behavioural practice survey*. Coordinated by The Planning Institute of Jamaica. Kingston: The Planning Institute of Jamaica. http://www.pioj.gov.jm

Carson, R. (1962). *Silent spring*. Greenwich, CONN: Fawcett Publications, Inc.

Declaration of Helsinki (2001). World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. *Bulletin of the World Health Organization*, *79*(4), 373-374.

Ele, M. (2016). Legal and policy framework for climate change adaptation and environmental protection. An Unpublished Paper Presented at the Joint International Seminar on Human Rights, Environmental Law and Children's Rights and Climate Change in a Post 2015 World: Global Call, Local Action, Held at the University of Nigeria, Nsukka, Enugu, Nigeria, November 2-3.

Eurobarometer. (2019). *Europeans' attitudes towards climate change Report. A survey sponsored by the European Commission and the European Parliament*. Directorate-General for Communication of the European Commission.

Guernier, V., Hochberg, M. E., & Guegan, J. F. (2004). Ecology drives the worldwide distribution of human diseases. *PLOS Biology*, *2*(6), 740–746.

Iwuchukwu, J., & Onyeme, F. (2013). Awareness and perceptions of climate change among extension workers of Agricultural Development Programme (ADP) in Anambra State, Nigeria. *Journal of Agricultural Extension*, *16*(2). https://doi.org/10.4314/jae.v16i2.9

Luka, E., & Yahaya, H. (2013). Sources of Awareness and Perception of the Effects of Climate Change among Sesame Producers in the Southern Agricultural Zone of Nasarawa State, Nigeria. *Journal of Agricultural Extension*, *16*(2). https://doi.org/10.4314/jae.v16i2.11

Lybbert, T. J., & Sumner, D. A. (2012). Agricultural technologies for climate change in developing countries: Policy options for innovation and technology diffusion. *Food Policy*, *37*(1), 114–123. https://doi.org/10.1016/j.foodpol.2011.11.001

Nederlof, E. S., Wennink, B., & Heemskerk, W. (2010). *Access to agricultural services. Background Paper for the IFAD Rural Poverty Report*. Amsterdam: Royal Tropical Institute. KIT Development Policies.

Oruonye, E. D. (2011). An assessment of the level of awareness of the effects of climate change among students of tertiary institutions in Jalingo Metropolis, Taraba State Nigeria. . *Journal of Geography and Regional Planning*, *4*(9), 513–517.

Sah, J. K., Bellad, A. A., & Angolkar, M. (2015). Assessment of the knowledge and attitude regarding global warming among high school students of Ramnagar, Belagavi city: A cross-sectional study. *Journal of Dental and Medical Sciences*, *14*(4), 74–78. https://doi.org/10.9790/0853-14467478

Selznick, P. (1948). Foundations of the Theory of Organization. *American Sociological Review*, *13*(1), 25. https://doi.org/10.2307/2086752

Selznick, P. (1949). *TVA and the Grass Roots: A Study in the Sociology of Formal Organization*. University of California Press, Berkeley, CA.

Sena, L. (2006). *Disaster prevention and preparedness* [Lecture notes for health science students]. Ethiopia Public Health Training Initiative, The Carter Center, the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education.

Simpson, B. M., & Burpee, C. G. (2014). *Adaptation under the new normal of climate change: the future of agricultural extension and advisory services*. A Discussion Paper Produced as Part of the United States Agency for International Development (USAID) Project "Modernizing Extension and Advisory Services" (MEAS).

Skalík, J. (2015). Climate Change Awareness and Attitudes Among Adolescents in the Czech Republic. *Envigogika*, *10*(4). https://doi.org/10.14712/18023061.472

United Nations Environmental Programme. (2007). *Global Environment Outlook GEO 4 environment for development United Nations Environment Programme*. https://na.unep.net/atlas/datlas/sites/default/files/GEO-4_Report_Full_en.pdf