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Workers' Compliance with Measures for Safe Environment in Quarry Industries in Abakaliki Town of Ebonyi State, Nigeria

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Hazards in quarry industries are unavoidable and inimical to the health of man and environment. Occupational health and safety measures mitigate the effect of the hazards. This study investigated the extent of workers' compliance with measures for safe environment in quarry industries in Abakaliki capital development territory of Ebonyi State. Descriptive survey research design was used for the study. The population of the study consisted of 3450 workers of quarry industries in the area under survey. A sample of 358 workers was chosen using proportionate stratified random sampling technique. The instrument for data collection was a 15-item structured questionnaire tagged Measures for Safe Environment Compliance Questionnaire (MSECQ). Internal consistency of the instrument was determined using Cronbach alpha co-efficient and the overall reliability coefficient was 0.96. Research questions were answered using mean and standard deviation while hypotheses were tested using t-test and one way analysis of variance. Alpha level for test of hypotheses was set 0.05. The results show that workers highly comply with measures for safe environment, exhibit high compliance with measures for safe environment in relation to reporting safety problems and every faulty equipment to management as well as working only when there is proper lighting. They show low compliance with measures for safe environment with regard to urinating into toilet/urinal within the quarry and defecating into toilet within the quarry. There is no significant difference between male and female workers in the level of compliance with measures for safe environment. There is significant difference in workers compliance with measures for safe environment based on level of education. It is recommended that the National Environmental Standards and Regulations Enforcement Agency (NESREA) should liaise with state and local health authorities in the health education of quarry workers and general control of quarries. Also, owners of quarries should take responsibility for every act of non-compliance in quarries and should ensure regular health education and training of workers and regular hazard control in the quarries.

1. Introduction

Safety of worker has been on the front burner since the era of industrialization and a priority to the United Nations. It is recognized as a basic human right in the United Nations universal declaration of human right, 1948. One of the commonest environmental and safety issues in Ebonyi State, Nigeria emanates from quarry industry because of the nature of its operations and the conditions under which it is managed and operated.
Quarries are open cavities where stone or slate are extracted from a deposit of rock and mined for use in construction projects. It involves the making of small rocks and aggregates from big rocks used for extracting building materials, such as dimension stone, construction aggregate, riprap, sand and gravel (Nwachukwu and Mbemene, 2012). In spite of the benefits derivable from quarry industries, the associated risk, hazards and consequent effects of quarrying on health of workers and host communities are enormous. Environmental effects of quarrying include landscape change, change to the visual scene, erosion, habitat loss, loss of flora and fauna, and stability problem. Others are noise, vibration, dust; security problem, effects on the amount of quality water and high traffic (Omasanya and Ajibade, 2011). Olusegun et al. (2009) stated that the psychological and health effects of quarry industries on workers include shock, nasal infection, asthma, predominant cough, catarrh and sinusitis inter alia. Dust is present at all quarries and presents differing level of risk to workers and the neighbourhood.

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Occupational health is the control of factors affecting health in work places. Like other aspects of preventive medicine, Park (2011) noted that occupational health aims at the prevention of diseases and the maintenance of the highest degree of physical, mental and social wellbeing of workers in all occupations. It involves health promotion, specific protection, early diagnosis and treatment, disability limitation and rehabilitations. The focus of occupational health is on health and safety of every worker in his place of work. Occupational health and safety services are targeted to prevent and control dangers from a workplace like the quarry industries. Every country has specific legal requirements to ensure a safe place of work, safe appliances (plant) and equipment as well as competent personnel. One of the major occupational health and safety services are environmental health measures to safeguard the workers' health and the work environment, which demands strict compliance.

Arewa and Farrell (2012) remarked that compliance is often used to mean an art of conforming to health and safety rules and regulations. It refers to safety behaviours like the use of personal protective equipment and others (Ford and Tetrick, 2011). In this study, compliance refers to obedience, acceptance and practice of health and safety measures in quarry industries.

Many man-made activities like quarrying cause momentous impact on the surroundings. It is often essential to blast rocks with explosives in order to extract material for processing but this method of extraction gives rise to noise and air pollution. Figure 1 shows the unfriendly behaviour of quarry operation to the environment.

Figure 1: Stages in stone crushing showing unfriendly behaviour to the environment

In Nigeria there is still small number of information on health and safety procedures among quarry workers as the few researches carried out were in the Southern (Ugbogu et al., 2009) and Northern (Aliyu and Shehu, 2006) parts of Nigeria. A groundwork study among quarry workers in Edo State, in southern Nigeria, showed a deficiency of awareness of the hazards and diseases related with working in the quarry industry and poor use of safety equipment, which might suggest some level of poor compliance (Aigbokhaode et al., 2011).

Quarries must be properly inspected and maintained to ensure the health and safety of all workers on site. Quarry workers' exposure varies with the job, its closeness to the cause of hazards, and the efficacy of hazard control methods (Weeks, 2011). Hazardous materials are responsible for annual death of several thousands of workers worldwide. In June 2006, the International Labour Organization adopted a convention on promotional framework for occupational safety and health, placing occupational safety and health on the national agenda in order to lower the toll of work-related injuries and diseases (Oginyi, 2010).

The majority of the practices in quarrying and the related activities of rock drilling, blasting, stone cutting, rock crushing, and aggregate manufacture generate dust, which can cause dangerous levels of airborne contamination in the workplace. Local rock has a high silica content that makes silicosis the major health hazard of exposed persons who inhale the dust. Among an unselected group of 126 quarry sites in Kano State Nigeria, radioactive evidence showed traces of silicosis in the quarry workers (Warrel, 1997). In Mumbai, India, it was found that each of the quarry operations generated airborne total dust and dust that contains very high percentage (75.0 %) of free silica (Backett, 1997). It was opined that at this level, quarry employees have estimated average exposure to air-borne total dust of 2.36 mg/m3 as against recommended level of permissible unit of exposure specified in Fulekar (1999).

In the United Kingdom, the quarry industry reportedly has the highest injury rate of any industry. In a 10 y period spanning 1991-2000, over 3036 workers in the quarry industry suffered significant injuries and there were 19 fatal injuries (Health and Safety Executive, 2017). Comparison of the occurrence of respiratory disease symptoms between manual quarry workers and a control population in Lokpa of Umuchieze, Abia State, shows that there was a higher occurrence of respiratory disease symptoms among the quarry workers.

There was also a higher occurrence of dermatoses among the quarry workers than in the control population. Majority of the quarry workers knew that their job exposed them to health hazards. About 87.0 % of them acknowledged that their working environment could negatively affect their health and about 83.0 % would prefer other jobs to quarrying (Ugbogu et al., 2009). In Abeokuta Nigeria, the most prevalent health problem of the residents near quarries was identified as nasal infection. Among the quarry workers, the common health problems diagnosed were cough, catarrh, sinusitis and silicosis (Olusegun et al., 2009).

In Zaria Nigeria, it was reported that out of 74 quarry workers 64.9 % of them were aware of the need to use safety devices and to institute safety/preventive measures at the worksites, despite their low level of education. All of the workers had history of one form of occupational hazard or another such as respiratory symptoms, cuts from the stones, eye irritations and skin irritations (Aliyu and Shehu, 2006). In a study conducted on environmental impact assessment of cement manufacturing in Edo State of Nigeria, it was reported that in 96.7 % of all the industries sampled, no worker used protective devices, thereby exposing them to hazards (Isa, 1999). Pollution studies around Sagamu and Ewekoro cement works in Ogun State have shown that several people are suffering from eye pain, and asthmatic attack due to the dust-laden air that prevails within a few kilometers radius of the factories (Aigbedion, 2005).

Sufiyan and Ogunleye (2012) revealed that majority of the quarry workers in Sabon-Gari Local Government Area of Nigeria knew that their job exposes them to health hazards. They have an appreciable level of consciousness on safety protective gadgets and use a number of these gadgets, which indicates varying levels of compliance with safety measures in quarry industry. Exhaustive health education crusade and provision of sufficiently subsidized safety shielding devices for the workers by the appropriate authorities will go a long way in improving consciousness and compliance with use of safety protective devices and lessening of hazards.

The study conducted in Zaria, Nigeria on the assessment of awareness and compliance to safety measures and use of protective devices in Sunsead Oil Company suggests partial compliance with safety measures in the establishment (Tuktur, 2017).

A common negative effect of quarrying minerals from the earth's surface is the destruction of its natural landscape, creating open space in the ground and generating heaps of rock wastes that cannot be easily disposed off. These phenomena are amply demonstrated in several parts of Nigeria, where commercial mining or quarrying had occurred in the past or is currently taking place (Eshiwani, 2014).

The study therefore aims at assessing level of workers' compliance with measures for safe environment in quarry industries in Abakaliki Capital Development Territory of Ebonyi State, Nigeria. This will be achieved by determining the workers level of compliance and by comparing compliance by the socio-demographic of gender, level of education and length of service in the quarry industry.

2. Methodology

The descriptive survey research design was used for the study. The population of the study consists of 3450 workers of quarry industries in Abakaliki Capital Development Territory. A sample of 358 workers was drawn using proportionate stratified random sampling technique. The instrument for data collection was a 15-item structured questionnaire tagged Measures for Safe Environment Compliance Questionnaire (MSECQ). The response columns of the questionnaire were graded as follows: Never = 1, Rarely = 2, Sometimes = 3 and Always = 4 as the case may be. Internal consistency of the instrument was determined using Cronbach alpha co-efficient and the overall reliability coefficient was 0.89, which is higher than a coefficient of 0.60 for good instruments (Ogbazi and Okpala, 1994). In order to establish the extent of compliance, the criterion mean was set at 2.50 indicating that any mean below 2.50 was considered low level of compliance while any mean score of 2.50 or above was considered high level of compliance. A 100 % return rate (358 copies) was achieved because of on-the-spot retrieval of questionnaire on completion by the respondents and these copies of the questionnaire were used for analysis. Research questions were answered using mean and standard deviation while hypotheses were tested using t-test and one way analysis of variance (ANOVA) at 0.05 alpha level. The demography of the respondents is presented in Table 1.

3. Analysis and results

3.1 Demographic analysis of the respondents

Table 1 indicates that there are more females (53.02 %) than males among the respondents. Analysis of educational attainment of the respondents indicates that most of the respondents have primary education (51.95 %) and secondary education (27.93 %) while a small proportion (8.37 %) attained post-secondary education. On length of service in a quarry industry, majority of the respondents (62.41 %) have served between 1-4 y, while 28.77 % have served for 5 y and above, others have served for less than one y.

Table 1: Demography of the respondents

Variable	n	%
Gender:		
Male	162	46.08
Female	196	53.02
Level of education		
Non-formal education	42	11.73
Primary education	186	51.95
Secondary education	100	27.93
Post-secondary education	30	8.37
Length in service (y)		
< 1	28	7.82
1 – 4	227	62.41
5 – above	103	28.77

3.2 Analysis of worker compliance with measures for safe environment

Table 2 shows that some of the respondents' mean score on compliance with measures for safe environment including check whether fire extinguishers were in right places, defecate into toilet within the quarry, urinate into toilet/urinal within the are below the criterion mean set for the study, indicating low compliance. The respondents mean score on other compliance including keep my work area clean, clean my personal protective equipment after every use, report every accident to my supervisor and report safety problems to supervisor are above the criterion mean set for the study. Other variables that have mean score above 2.50 include ensure that caution signs are put at necessary places, and work only when there is proper lighting. It suggests that the variables have high compliance with measures for safe environment. The respondents mean score for workers compliance with measures for safe environment is above the criterion score set for the study and this indicates high workers compliance with measures for safe environment in quarry industries in Abakaliki Capital Development Territory of Ebonyi State. Table 2 shows that the workers compliance with occupational health and safety measures for safe environment is high. This result is similar to the findings of Garcia et al. (2013) which showed that industrial workers they studied in Castellon, Spain had high compliance with occupational health and safety measure for safe environment. Nzuve and Lawrence (2012) presented a result of 66.05 % compliance with hygiene regulation, which had the possibility of encouraging safe environment among registered workers in Nairobi. In spite of similar findings in related industries, the finding of this study was not expected. Physical observation of the quarries visited showed many unsanitary activities among workers. This study result shows that workers neither urinate nor defecate in any sanitary convenience within the quarry environment. The implication is that workers defecate and urinate indiscriminately, an unsanitary behaviour that may promote faeco-oral diseases outbreak.

Table 2: Workers compliance with measures for safe environment

S/N	Statement	$\bar{x}$	SD	*Dec.
1.	Keep my work area clean	3.55	0.76	HC
2.	Clean my personal protective equipment after every use	3.35	1.05	HC
3.	Keep my work equipment in safe working condition	3.72	0.66	HC
4.	Report every faulty equipment to my management	3.75	0.65	HC
5.	Defecate into toilet within the quarry	1.84	1.14	LC
6.	Urinate into toilet/urinal within the quarry	1.82	1.11	LC
7.	Report every accident to my supervisor	3.78	0.59	HC
8.	Report safety problems to supervisor	3.58	0.70	HC
9.	Ensure that caution signs are put at necessary place (s)	2.89	1.16	HC
10.	Check whether fire extinguishers are in right places.	2.45	1.37	LC
11.	Work only when there is proper lighting.	3.78	0.75	HC
12.	Compliance with measures for safe environment	3.13	0.54	HC

* HC = High compliance, LC = Low compliance, Dec = Decision

It equally suggests absence of sanitary conveniences in quarries in the study area. Absence of sanitary convenience in any industry will normally lead to pollution of air and water sources and contamination of other items in the environment. Approving and supervising agencies should ensure that sanitary convenience is provided in all quarry industries

3.3 Analysis of compliance by socio-demographic variable respondents

Table 3 indicates that there is a difference by gender in compliance with measures for safe environment. Females have higher compliance than the males and this difference was found to be significant. With regard to level of education, respondents who have post-secondary education have the highest mean compliance score, followed by those with secondary education. Those with non-formal education have the least mean compliance score. When ANOVA was run the difference was significant. For education as expected, there was a progressive increase in compliance with measures for safe environment in the quarries with higher level of education. As regards length of service, the workers that are below 1 y in service have higher mean compliance than older workers. When ANOVA was run, the difference that exists in their mean compliance was not significant. The finding that there is difference in compliance by gender supports the position of Cruz et al. (2017) that men and women face different levels of workplace risk and there is need to design gender specific safety interventions that provides for specific protections, especially for women in non-traditional occupation like quarry industries. Bamidele et al. (2011) identified significant association between level of education and years of service; this finding differs with the finding of this study, which reported no significant association between years of service and compliance. The finding that older worker had lower compliance might be accounted beliefs of having gained enough experience and the carelessness that comes with such assumptions. This calls for interventions to improve knowledge of environmental safety practices and closer supervision to improve compliance. The intervention could be in the area of education and training, which, of course, has been suggested, in a previous study (Egba et al., 2017).

Table 3: Distribution of compliance with measures for safe environment by gender, level of education and length of service in quarry

Variable	n	$\bar{x}$	SD	Statistic	p-value	Decision
Gender						
Male	162	3.11	0.43			
Female	196	3.31	0.44	t = 0.67	0.5	NS
Level of education						
Non-formal education	42	2.77	0.49			
Primary education	186	3.10	0.53	F = 12.53	0.000	S
Secondary education	100	3.26	0.49			
Post-secondary education	30	3.42	0.46			
Length in Service (y)						
< 1	28	3.13	0.71			
1 – 4	227	3.12	0.53	F = 0.18	0.08	NS
5 - Above	103	3.11	0.49			

4. Conclusions

The health of workers in any industry is of paramount importance to owners of such industries. That may be the reason for adoption of safety measures for safe environment. Measures adopted for safe environment include and may not be limited to reporting dangerous activities around and within any industrial environment in quarries. Since workers in quarry industries in the area under survey exhibited an overall high level of compliance with measures for safe environment, it could be suggested that environment within and around the quarries would be friendly.

It was observed that there are no conveniences in and around the quarries where the workers defecate or urinate. The consequence of the lack of conveniences could be open and surface defecation among the workers. It was shown in the study that workers who had post-secondary and secondary education reported higher level of compliance with measures for safe environment. Intervention through workshop and training should target those with lower levels of education. Due to the limitation of survey research of this nature, the results of this study may not be used to make sweeping generalization to quarries outside the area of study.

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