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Assessment of Workplace Hazard and Safety Performance of the Construction Industry

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Abstract

The Construction industry contributes significantly to the socio-economic improvement of any country. Notwithstanding its significance, the Construction industry has been categorized as one of the greatest dangerous industries across the world. This investigation appraised the workplace hazard and safety performance of the Construction industry in the Asaba, Delta region of Nigeria. Qualitative and Quantitative study survey technique was deployed. The collected data was analyzed to define the safety performance of the industry. T-test and ANOVA statistics were used to institute the significant effect on safety administration application in the industry. This work reveals that the proprietor and member of staff have appropriate consciousness of job-related healthiness and security then there are policies and systems in place to make the workplace safe. Workers are not exposed significantly at 95 % to security and health risks in the workstation, and the workforces are not contributing significantly at 5% significant level to making a workstation secure for employees. Workers should be contributing to making a workstation safe for workers for it is the function of staff activities and skills; the manager's activities and practices. The outcomes of the finding point out that an improved welfare and exposure involvement of all personnel in the construction industry would bring positive changes in the employee's attitude and better-quality of the site throughput in Nigeria.

Keywords: Hazard and Safety Performance, Construction Industry
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1.0 Introduction

The construction industry has frequently been condemned for its inadequate performance in safety and health. The principle of safety in construction is for a reservation the life expectancy of workers and material goods. The construction industry is the core of social and economic growth in all nations of the biosphere (Agwu, & Olele, 2014). Nevertheless, the construction industry contributed only about 1.98% of the overall Gross Domestic Product (GDP) to the Nigerian budget in 2009, its significance and roles in the growth of the economy of any country cannot ever be doubtful. Traditionally, construction remains an industry where labours may sense that taking risks is a part of the work and may worry about what their peers think of those who take extra precautions. The reality is that construction workers are more exposed toworkplace injuries because of the inherent dangers of a job that often involves working with large machinery and power tools (Cesarini et al. 2013).

Safety performance on construction sites is usually measured using lagging indicators such as accidents and not by using leading indicators such as safe work behaviors. Customarily, safety in construction sites has always been determined bythe level of execution of safety measures and guidelines, and danger control pieces of machinery. Safety culture is the precedence concern of people working in a society; though, emphasizing that society can only be recognized with safety culture after it has advanced to a certain phase (Adeogun and Okafor, 2013). The construction industry adds to the improvement and development of any state. Undertakings of the industry are energetic to the socio-economic growth objectives of the country by providing work, accommodation, and infrastructure. The construction industry gives an average of over 3% to the annual gross domestic product and an average of about one-third of the total fixed capital investment in Nigeria (Oladinrin et al.2012) Though, the construction industry has been categorized amongst the utmost hazardous industries in the globe.

In many countries such as Great Britain, mortalities in the construction area cover38% and are documented to be the maximum as related to other subdivisions such as 29% for agriculture, 12% kor waste, and 15% for both transport and storage and manufacturing. (Idoro, 2011; Windapo and Jegede, 2013). The

industry alone yields 30% of the entire deadly engineeringcalamities across the European Union (EU), nonetheless, it employs only 10% of the employed populace (McKenzie et al. 999.). In the United States of America (USA), the construction industry accounts for 22% of totally mortal misfortunes, in Japan 30%-40% and the United Kingdom (UK) 25% of the global manufacturing mishaps (Bomel, 2001 & Hassan *et al*.2007).

Brown (1996) noted how safety is governed in the construction industry that has not been transformed over the years substantially. In the manufacturing division, the operational environment and the work techniques continue essentially unaffected from day-to-day. These consist of deficiencies in the current universal level of safety and health education, general indifference and contentment towards safety and health problems, deficiency of quality and commitment of site organization, deficiency of sufficient possessions assigned to safety and health. Prior researchers have stressed that no dependable data on misfortune cases exist in the Nigerian construction industry for contractors neither report mishaps properly nor preserve appropriate registers on calamities. (Agwu & Olele, 2014).

Overemphasis at location level on construction goals to the understandable loss of worthy safe working practices, failure of theadministration to set sufficient assets into safety implementation, and the deficiency of emphasis on the portion of some constructionexperts in safety and health subjects. Cariel (1991) added that only with suitable administration commitment, establishment,and planning, it is promising to attain safer working environs that are also budget effective. The comprehension of the expenses of accidents and human suffering have transported changes in the assertiveness of administration and employees to safety. The implication of guaranteeing safety in the work atmosphere is primarily supported by diverse educations as the work location is uncovered to inherent hazards and risk issues that exact undesirable effects on the organization's total performance. Subsequently, the construction industry introduces one of the most dangerous industries. There is an extensive deviation in economic organizations, occupational constructions, working situations, work atmosphere, and the health rank of workforces in diverse areas of the biosphere, in diverse nations, and diverse regions of the economy. Hence the modernization of the construction productiveness is not even throughout the biosphere. Nevertheless, construction productiveness plays an energetic role in improving the economy of any nation, specifically an unindustrialized nation. It offers the structure required for other areas of the economy to be an embellishment.

Coble and Haupt (1999) had presented that the construction industry echoes the level of economic expansion within the nation. The construction zone all over faces difficulties and trials. Conversely, in unindustrialized nations, these complications and trials are present together with an overall level of socio-economic trauma and a lesser production rate when likened to advanced nations (Ofori, 2000). However, it is largely understood that construction productiveness is a decent source of occupation at numerous levels of expertise, from broad labour to semi-skilled, skilled, and expert labour force. The deficiency of research and development, shortage of trade and safety training, customer displeasure, and the uninterruptedly growing construction expenses are other key areas that influence the construction industry

Construction within emerging nations frequently fails to meet the requirements of contemporary modest industries in the marketplace and hardly offers the paramount value for customers and taxpayers (Datta, 2000). Moreover, this segment reveals pitiable performance in respect of quality administration and safety principles due to the lack of any severe safety and construction regulations. The unfortunate quality organization and safety philosophy registers in construction plans within unindustrialized nations were attributed to the great proportion of minor companies and the great number of entrepreneurial workers; the diversity and relatively short life of construction places; and the extraordinary turnover of workers; and the huge amount of periodic and refugee workers. In an unindustrialized nation, there are no training plans for workforce and personnel; so, no orientation for the fresh workforce is accompanied; dangers are not pointed out, and no safety conferences are held. Workforces are expected to acquire from their faults and practice. (Kartam, 1997; Kartam and Bouz, 1998 & Kartam, et al., 2000)

In embracing diverse methods to quality administration and safety beliefs in technologically advanced and emerging nations, two core changes can be recognized. The first is the presence of regulation and its effective execution; the second is risk consciousness. In advanced nations, numerous safety acts and regulations occur and are executed efficiently. Designated safety officers uphold hazard consciousness with the aid of steady safety training meetings. In unindustrialized nations, but, safety guidelines scarcely exist at all; and when they do, they

are unsuitable, unproductive, obsolete, and built on circumstances that triumphed while the nation was still being occupied. Furthermore, the supervisory expert is regularly very feeble in executing guidelines efficiently, and work risks are either not observed at all, or observed to be less hazardous than they are (Larcher and Sohail, 1999; Hinze *et al*., 1999).

Ugwu et al. (2021) assessed of Safety Performance of the NigerianConstruction Industry and stated that the topmost supervision is committed to the application of occupational health and safety administration hence there would be improved safety practices and reduced frequency of calamities. Izobo-Martins et al (2018) presented safety in Construction: reducing the bodily Stresses onEmployees in Nigeria and it was that an enhanced safety attitude and ergonomics of the bodily demands on all labours in the construction industry would bring variations in the workforce attitude and better-quality of the site throughput in Nigeria. This study examines the operative execution of a safety administration system in the construction industry to ensure the best performance and determine the consequence of safety administration on project performance in a construction firm

2.0 RESEARCH METHODOLOGY

Research Design

The survey was conducted with a Construction Company in Asaba, Delta state. It comprised structured questionnaires that were distributed to over 70 construction workers, contractors, and consultant organizations. A total of 55 members of staff were available to complete the survey, 37 responses were received which makes a 67 percent return rate. A series of interviews with both safety managers and quality managers were held during the same period.

Questionnaire Structure:

The questionnaire consists of 4 sections and is planned to discover the workplace health and safety at Aba, Abia State Nigeria. The participants were requested to share their views about the workstation and how it upsets health and safety by taking this survey. The questions on the hazards confronted on the job and the occupational health and safety (OHS) guidelines and procedures in place to defend the employee. The survey is unsigned and the answers assisted to determine areas that may need enhancement to better defend the safety and health of employees.

Section 1: Workplace exposures

This segment requests about the types of health and safety menaces workers might be exposed to in the occupation. The best defines how often participants do the stated job or are wide-opened to the stated situation.

Section 2: Workplace guidelines and measures

This section explains the varieties of policies and systems in place to make the workstation safe. The best defines how much participants approve or differ with the declaration.

Section 3: Occupational healthiness and safety consciousness

This section discovers worker's consciousness of occupational healthiness and security, the best defines how much partaker approves or differs from the declaration.

Section 4: Contribution in occupational healthiness and security

This unit discovers worker's ability to request about, and contribute to, well-being and protection at work, the best defines how much participants support or differ from the declaration.

Hypotheses

Four (4) hypotheses were itemized on the hazards encountered on the work and the job-related healthiness and security strategies and measures in place to defend the employee

Hypothesis 1

Ho: There are no significant healthiness and safety threats employee is exposed to at the workplace.

H1: There is significant healthiness and safety threats employee is exposed to at workplace.

Hypothesis 2

Ho: There are no significant plans and schemes in place to make the workplace harmless.

H1: There are significant plans and schemes in place to make the workplace harmless

Hypothesis 3

Ho: There is no significant consciousness of job-related healthiness and security such as dangers, the moralities, and duties of both personnel and managers).

H1: There is significant workers' consciousness to job-related healthiness and security such as dangers, the moralities, and duties of both personnel and managers).

Hypothesis 4

Ho: There is no significant involvement of workers in making a workstation harmless for staff depends on both employees' activities and aptitudes and the employer's activities and practices

H1: There are significant involvement of workers in making a workstation harmless for staff depends on both employees' activities and aptitudes and the employer's activities and practices. The hypotheses were tested using t-test and ANOVA analysis at a 95% confidence limit.

T-test analysis

The t-test is used for testing hypotheses concerning the mean of a small trial occupied population when the standard deviation of the populace is not identified. The t-test defines if there is a significant difference between the means of the two groups. T-test principles estimate values that are compared with standard values, when the null and alternative hypotheses are recognized, the **null hypothesis** is either accepted or rejected.

The T-test is related to the z-test and f-test but the t-test is typically executed where the trial size, n is insignificant ($n \leq 30$). T-value was determined using Eqn (1) **(**Kothari, 1990)

$$t = \frac{\bar{x}+\mu}{\frac{\sigma^2}{\sqrt{n}}} \qquad (1)$$

where $\bar{\mathbf{x}}$ is the mean of the trial, and **μ** is the assumed mean, **σ** is the standard deviation, and **n** is the number of observations.

T-test for the difference in mean was determined using Eqn (2) **(**Kothari, 1990)

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n_1-1)\sigma_1^2 + (n_2-1)\sigma_2^2}{n_1+n_2-2}} \times \sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \qquad (2)$$

where $\bar{\mathbf{x}}$**1** and $\bar{\mathbf{x}}$**2** are the mean of two samples and **σ1** and **σ2** is the standard deviation of two samples, and **n1** and **n2** are the numbers of observation of two samples.

Analysis of Variance. ANOVA

ANOVA utilizes the F-test for statistical significance. This allows for the contrast of many means at once for the error is estimated for the entire set of comparisons rather than for each two-way contrast. The F-test evaluates the difference in each group mean from the global group alteration. If the change within groups is smaller than the change between groups, the F-test gets a higher F-value, and consequently, a superior chance that the discrepancy observed is real and not owing to possibility.

The null hypothesis (H_0) of ANOVA is that there is no alteration among set means. The alternate hypothesis (H_a) is that at least one group differs considerably from the general mean of the dependent variable.

P-value is the possibility of finding a test statistic that is at least as severe as the actual calculated value if the null hypothesis is true. A universal cut-off value of the p-value is 0.05, if the calculated p-value of a test statistic is less than 0.05 that the null hypothesis is discarded.

The hypothesis test

The essential ANOVA analysis consists of a succession of calculations as presented in Table 1.0. **(**Kothari, 1990, Kothari, 2002).

Table 1.0 Two-way ANOVA table for Block Randomized Experiment (Kothari, 2002)

Source of variation	df	Sums of squares	Mean square	F
Factor A	k - 1	SSA	$MSA = \frac{SSA}{k-1}$	$F_A = \frac{MSA}{MSE}$
Factor B	l - 1	SSB	$MSB = \frac{SSB}{l-1}$	$F_B = \frac{MSB}{MSE}$
Interaction AB	$(k-1)(l-1)$	SSAB	$MSAB = \frac{SSAB}{(k-1)(l-1)}$	$F_{AB} = \frac{MSAB}{MSE}$
Error	$kl(m-1)$	SSE	$MSE = \frac{SSE}{kl(m-1)}$	
Total	klm - 1	SSTo		

The df is the degrees of freedom for the independent variable. The Sum Square is the addition of squares between the set means. The Mean Square represents the summation of squares, calculated by dividing the summation of squares by the degrees of freedom. The F-value is the ratio of the mean square of each independent variable to the mean square of the residuals. F-value is calculated using Eqn(3)

$$F = \frac{MS\ (Factor)}{MS\ (Error)} \quad (3)$$

Mean squares (MS) is the design for the mean square for the factor in Eqn (4):

$$MS\ Factor = \frac{SS\ (Factor)}{DF\ (Factor)} \quad (4)$$

The design for the mean square for error is obtained using Eqn(5)

$$MS\ Error = \frac{SS\ (Error)}{DF\ (Error)} \quad (4)$$

Where MS is Mean Square, SS is Sum of Squares and DF is Degrees of Freedom

4.0 RESULTS AND DISCUSSION

A total of 55 members of staff were available to complete the survey, 37 responses were received, a 67 percent return rate. The reason for failing to complete the questionnaire was mainly related to lack of time, although it was clear that some senior members of staff thought the questionnaire impinged on the management function.

Data Analysis

The purpose of each question is stated while carrying out the analysis and the result is demonstrated using appropriate charts and statistical tests. Questions are grouped as some questions are relevant to each other, making the analysis of responses to those questions more sensible. Assessment of workplace safety and health study was conducted at, Aba, Abia State Nigeria.

Workstation Hazards

Figure 1 presents how often personnel exposes to workstation menaces with durations of daily, weekly, and monthly assessments.

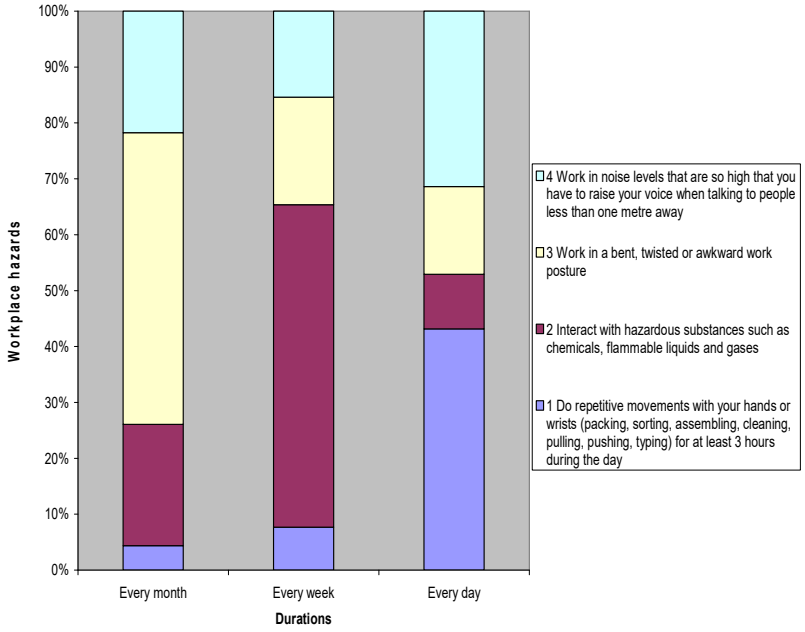

Figure 1.0: Graph of workstation hazards versus duration

Daily assessment, 4% of workers do recurring movements with the hands or wrists, 22% of staff relate with risky substances such as gases, combustible liquids, and chemicals, 52% of personnel work in a bent, twisted, or awkward work position and 22% of workers work in high-level noise environment that require the worker to raise voice when speaking to people less than one meter away

Weekly assessment, 8% of workers do recurring movements with the hands or wrists, 52% of staffs relate with risky substances such as gases, combustible liquids, and chemicals, 19% of personnel work in a bent, twisted, or awkward work position and 15% of workers work in high-level noise environment that require the worker to raise voice when speaking to people less than one meter away

Monthly assessment, 43 % of workers do recurring movements with the hands or wrists, 10% of staff relate with risky substances such as gases, combustible liquids, and chemicals, 16% of personnel work in a bent, twisted, or awkward work position and 31% of workers work in high-level noise environment that require the worker to raise voice when speaking to people less than one meter away

ANOVA analysis was conducted to examine whether the workers are exposed to health and safety menaces in the workstation.

Hypothesis 1

Ho: There are no significant health and security threats at the workplace, and H1: There are significant health and security threats at the workplace.

Table 2.0 presents the summary of ANOVA analysis at a 5 % significance level, which decides to admit or discard the hypotheses

Table 2.0: One Way ANOVA Analysis for Workplace Menaces with Durations

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	118.1667	2	59.08333	1.552555	0.263471	4.256495
Within Groups	342.5	9	38.05556			
Total	460.6667	11				

Table 1.0 ANOVA analysis reveals that F value =1.552555 is less than F-Critical = 4.256495, and P-value is 0.2634 is greater than P-Critical of 0.05. It indicates that Ho is accepted while Hi is rejected, therefore ANOVA confirms that employees are not significantly exposed to health and security threats in the workstation or occupation

Job-related Healthiness and Security Perspective

Figure 2 presents the respondents' views on job-related healthiness and security perspective

14% of workers strongly agreed to point out to administration whenever a risk is observed at the workstation, 50% of employees strongly agreed to stop the task if an unsafe condition arises and management will address the condition, and 36% of staff strongly settled that there is adequate time to complete work unharmed

54% of workers agreed to point out to administration whenever a risk is observed at the workstation, 21% of employees agreed to stop the task if an unsafe condition arises and management will address the condition, and 25% of staff settled that there is adequate time to complete work unharmed.

32% of workers disagreed to point out to administration whenever a risk is observed at the workstation, 26% of employees disagreed to stop the task if an unsafe condition arises and management will not address the condition, and 42% of staff disagreed that there is adequate time to complete work unharmed

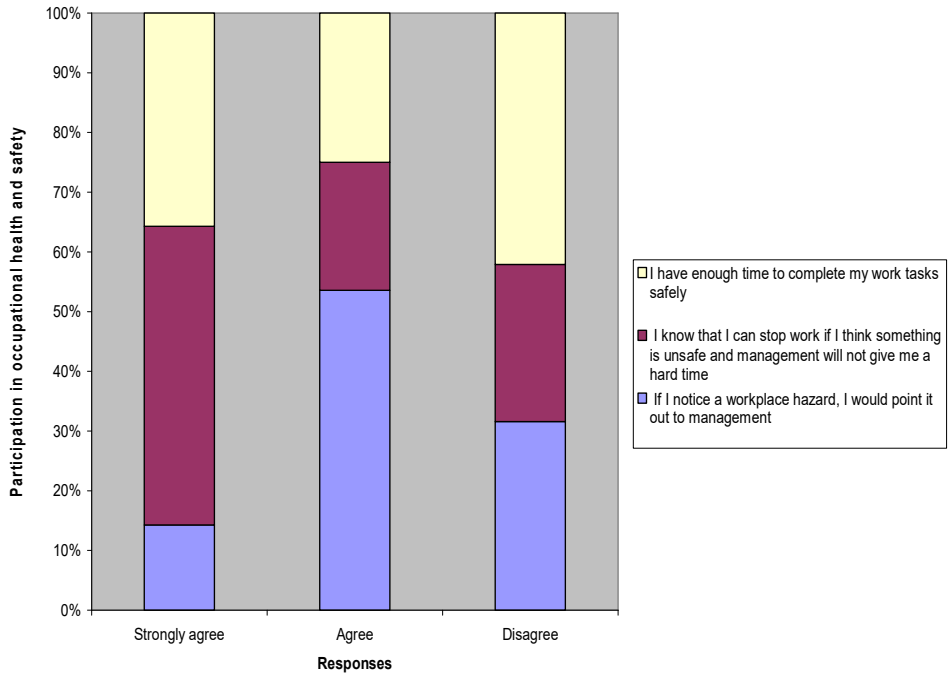

Figure 2.0: Plot of involvement in job-related healthiness and security versus workers' views

ANOVA analysis was conducted to further study the involvement of workers in making a workstation harmless for staff depends on both employees' activities and aptitudes and the employer's activities and practices

Hypothesis 2

Ho: There is no significant involvement of workers in making a workstation harmless and H1: There is significant involvement of workers in making a workstation harmless

Table 3.0 presents the summary of ANOVA analysis at a 5 % significance level, which decides to admit or discard the hypotheses

Table 3.0: One Way ANOVA Analysis for the Involvement of Workers in Making a Workstation Harmless

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	18	2	9	0.519231	0.6194704	5.14325285
Within Groups	104	6	17.33333			
Total	122	8				

Table 3.0 ANOVA analysis reveals that F value = 0.519231 is less than F-Critical = 4.256495, and P-value is 0.6194704 is greater than P-Critical of 0.05. It indicates that Ho is accepted while Hi is rejected, therefore ANOVA confirms that employees are not significantly involved in making a workstation harmless for staff which depends on both employees' activities and aptitudes and the employer's activities and practices.

Workplace Guidelines and Measures

This section inquiries the varieties of policies and systems in place to make the workstation secure. The findings revealed that 81% of workers robustly agreed that there are plans and schemes in place to make the workplace harmless and 19% of workers approved that there are plans and schemes in place to make the place of work risk-free. T-test analysis was performed to examine the significance of the different policies and systems in place to make the workstation risk-free.

Hypothesis 3

Ho: There are no significant plans and schemes in place to make the workplace harmless, and H1: There are significant plans and schemes in place to make the workplace harmless

Table 4.0 presents the summary of T-test analysis at a 5 % significance level, which decides to admit or discard the hypotheses.

Table 4.0: T-Test Analysis for Policies and Systems in Place for Two-Sample Unequal Variances

	Variable 1	*Variable 2*
Mean	20.28571429	4.714285714
Variance	2.904761905	2.904761905
Observations	7	7
Hypothesized Mean Difference	0	
df	12	
t Stat	17.09256381	
P(T<=t) one-tail	4.32781E-10	
t Critical one-tail	1.782287548	
P(T<=t) two-tail	8.65561E-10	
t Critical two-tail	2.178812827	

Table 4.0 t-test analysis reveals that t Stat=17.09256381 is greater than both t-Critical one-tail = 1.782287548 and t-Critical two-tail = 2.178812827, P-values are less than P-Critical of 0.05, then Hi is accepted but Ho is rejected,

therefore t-test confirms that the proprietor and worker have significant plans and schemes in place to make the workplace harmless

Job-Related Healthiness and Safety Consciousness

This section describes worker's consciousness of occupational health and security such as risk, human rights, and duties of both workforces and managers. The findings revealed that 26 % of workers robustly agreed that there is a worker's consciousness of occupational health and security such as threat, and duties of both workforces and managers, and 74% of workers approved that there is a worker's consciousness of occupational health and security such as the civil rights, and duties of both workforces and managers. T-test analysis was executed to examine the significance of the worker's consciousness to occupational health and security

Hypothesis 4

Ho: There is no significant workers consciousness to job-related health and security and H1: There is significant workers' consciousness to job-related health and security

Table 5.0 presents the summary of T-test analysis at a 5 % significance level, which decides to admit or discard hypothesis 4.

Table 5.0 T-test Analysis For Worker's Consciousness To Occupational Health and security for Two-Sample Unequal Variances

	Variable 1	*Variable 2*
Mean	6.333333333	18.33333333
Variance	30.26666667	29.86666667
Observations	6	6
Hypothesized Mean Difference	0	
df	10	
t Stat	-3.790523836	
P(T<=t) one-tail	0.001770172	
t Critical one-tail	1.812461102	
P(T<=t) two-tail	0.003540345	
t Critical two-tail	2.228138842	

Table 5.0 t-test analysis reveals that t Stat=3.790523836 is greater than both t-Critical one-tail = 1.812461102 and t-Critical two-tail = 2.228138842, P-values (0.001770172 / 0.003540345) are less than P-Critical of 0.05, then Hi is accepted but Ho is rejected, therefore t-test confirms that the owner and worker have significant proper consciousness to job-related healthiness and security such as dangers, the moralities, and duties of both personnel and managers.

Conclusions

The Construction industry contributes significantly to the socio-economic improvement of any country. This work has appraised the workplace hazard and safety performance of the Construction industry in the Asaba, Delta region of Nigeria. The following conclusions are drawn after the analysis of the Workplace health and safety survey at Aba, Abia State Nigeria that the manager and member of staff have appropriate consciousness of job-related health and security such as risks, the moralities, and duties of both staff and proprietors, then there are documentations and systems in place to make the workstation secure. Personnel is not exposed to health and safety risks in their workstation or occupation, hence the workforces are not sharing in making a workshop safe for staff which depends on both member of staff activities and skills and the company's schedules

and practices. Staff should be partaking in making a workstation safer for personnel which depends on both member of staff activities and skills and the company's schedules and practices. The outcomes of the finding point out that an improved welfare and exposure involvement of all personnel in the construction industry would bring positive changes in the employee's attitude and better-quality of the site throughput in Nigeria.

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