ASJ: *International Journal of Health, Safety and Environments (IJHSE)*
Vol. 3(5) 15 August, 2017, Pp. 81-101
www.academiascholarlyjournal.org/ijhse/index_ijhse.htm
ISSN: 2360-9311©Academia Scholarly Journals
Indexed In: Directory of Research Journals Indexing - http://www.drji.org
Also Available@; https://archive.org/details/Akalonu_et_al
Open access

Full Length Research

Awareness Assessment on Causes of Occupational Injuries, Illnesses and Fatalities for Selected Companies in Nigeria

George I. Akalonu[1], Ify L. Nwaogazie[1±] and Ejikeme Ugwoha[1]

[1]Centre for Occupational Health and Safety, University of Port-Harcourt, Nigeria.

Accepted August, 10, 2017

The present study examined the general causes of injuries, illnesses and fatalities among the workforce in three industrial sectors located in the Niger Delta Region of Nigeria. A total of 663 copies of questionnaires were distributed for data collection among 11 sampled companies found in the Oil and Gas industries, Construction sector, Transportation and Logistics. In data collection, the purposive sampling technique was applied while XLSTAT 2016 version 4.06 statistical software package was employed for data analysis. The applied methodologies used for analyses of collected data, are the Friedman test used to examine variance among the various respondents' groups; Multiple Pairwise comparisons (post hoc) of responses among the various sampled groups utilizing the Nemenyi's procedure on two tailed test; Shapiro-Wilk test of Normality for determination of data type used for choice of analytical process to be applied for parametric and non-parametric data. Principal Component Analysis was applied to determine major components common among the various sampled respondents with respect to general causes of injuries, illnesses and fatalities. The results from the study revealed high level of awareness on the causes of injuries, illnesses and fatalities among the sampled oil and gas companies. However, the level of workforce awareness differs from company to company. Furthermore, recommendations were made on how to improve the awareness of the workforce on injuries, illnesses and fatalities causatives in order to reduce and or prevent their occurrence.

Key words: Illness, Fatalities, Injuries, Oil and Gas Industries, Construction Companies, Transportation and Logistics Companies, Principal Component Analysis.

INTRODUCTION

According to Jain and Rao (2014) an accident can occur by any unplanned and uncontrolled event caused by human, situational or environmental factors or any combination of these factors which interrupts the work process and has the potential to result in minor or major injury, illness, damage or undesired event. Occupational Injuries, illnesses and fatalities have continued to be a great challenge facing the management of various industries and establishments in the Nigerian economy and beyond. Efforts put in place by various organizations to prevent occupational injuries have yielded results that still need improvements. Approaches to prevent injuries differ from industry to industry depending on

± **Correspondence: ifynwaogazie@yahoo.com**

available technology and knowledge of these injury causing agents which in most cases are caused by improperly managed hazards which lead to accidents in the workplace. In Nigeria, Occupational Injuries, Illnesses, Fatalities and Accidents (OIIFA) cases escalated as a result of industrialization and is more prevalent in those regions of the country such as the Niger Delta, where there is a high concentration of oil and gas, construction, transportation and logistics companies. Ezenwa (1996; 2001) observed that majority of the developing countries (Nigeria inclusive) are becoming industrialized, as such technological risks of accidents and occupational diseases are imminent. In practical terms and closer examination of those impacted by these injuries in the workplace Valentic et al. (2005) discovered, that the workforce mostly affected are those that are in the field who have a direct interface with the machines, equipment and or environment, as opposed to management personnel who are mostly in the offices. Injuries suffered by management personnel are those closely associated with musculoskeletal disorders (Nwaogazie and Ekwemuka, 2015; Nwaogazie et al., 2016).

An evaluation of the injuries suffered by the workers include but not limited to cuts, abrasions and bruises, bone fracture, laceration, joint dislocation, chemical injury, burns, sprains and strains, crush injuries, foreign bodies in the eyes, flanges of fingers or whole hand amputation, thermal injury and electric shock. Ajayi and Okegbemiro (1998) noted that many factors are contributory to the occurrence of accidents and injuries in the oil and gas industries in Nigeria and elsewhere. Some of the factors are unsafe acts, workers age, poor house-keeping, experience and job training, visual acuity, bypassing safety procedures, reaction time, intelligence, emotional instability, noise and hearing defects, fatigue, poor communication, poor concentration, marital status and illumination.

In the construction sector, World Bank (2016), opined that Nigeria is the most populous country in Africa and also the largest economy with the construction industry playing a vital role. From 2010 to 2014 the construction industry contributed 2.88%, 3.31%, 3.05%, 3.59% and 3.82% respectively of Gross Domestic Product (GDP) to the Nigerian economy, making it the 7th contributor to National growth in 2015 as compared to other subsectors of the economy (Okoye, 2016).

According to Sumaila (2013) a research report showed that the second largest road network in Africa is found in Nigeria. Again, in 2009, the World Health Organization (WHO) ranked Nigeria 149th out of 178 member countries, as a country with high vehicular road traffic accidents. Research has also shown that there is an intense traffic pressure on existing roads with a population to road ratio of 860 persons per square kilometer (FRSC, 2012). In 2012, there were 5,084 annual deaths recorded in Nigeria, giving an average rate of fatality of 5 persons per a 100,000 population in 8,153 road traffic crash cases. These reports, show that road traffic crashes are as a result of over speeding, impatience, recklessness, complacency, drug and alcohol use, loss of control, dangerous driving, brake and mechanical failure, dangerous overtaking, poor road conditions, tyre burst, poor vehicle condition, bad weather condition and poor journey management. This study is aimed at taking an expository look into the factors responsible for causing injuries, illnesses and fatalities in selected oil and gas, construction, transportation and logistics companies in the Niger Delta region of Nigeria.

METHODOLOGY

Study Area

The eleven (11) companies studied of which three (3) are from the oil and gas industry, four (4) from the construction sector while the last four (4) companies are from the transportation and logistics industry, are all located within the nine (9) States in Niger Delta region of Nigeria. The region comprises of the following State (and cities): Akwa-Ibom (Eket and Uyo); Rivers State (Port-Harcourt and Bonny); Bayelsa (Yenagoa); Cross River (Calabar); Delta (Warri); Edo (Benin); Imo (Owerri); Abia (Aba and Umuahia); Ondo (Akure).

The Niger Delta region covers well over 70,000 Km^2 (27,000 mi^2) of land area. This figure, represents about 7.5% of total land mass of Nigeria and lies on coordinates 05º 19’ 34” N, 06º28’ 15” E. It is densely populated with about 41million people. The Niger delta is bounded on the south by the Gulf of Guinea within the Atlantic Ocean and on the east by Cameroon.

The Niger Delta region is blessed with oil and gas exploration and production companies, which make the area, a beehive of commercial activities. It is on

Figure 1. Map of Nigeria Showing the Exact Position of the Niger Delta States. Source: Stratfor (2012).

record, that the main stay of Nigeria's economy comes from foreign exchange earned from the exportation of oil and gas products. Hence, well over 90% of Nigeria's foreign exchange earnings come from this sector. This equally explains why the area is densely populated with people engaged in various activities to earn a living. Figure 1 represents the map of Nigeria showing the exact position of the Niger Delta States.

Data Collection

The sampling technique employed for data collection was the purposive sampling technique. For purposive sampling, the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Nwaogazie, 2011). The collected data were grouped into three data sets with data set 1, representing those collected from oil and gas companies; data set 2, representing those collected from Construction companies and data set 3, presenting those from Transportation and Logistic companies.

For purpose of confidentiality, the three (3) oil and gas companies were represented as OG1, OG2 and OG3. Also, the four (4) construction companies were depicted as CC1, CC2, CC3 and CC4 while the four (4) transportation and logistics companies denoted as TL1, TL2, TL3 and TL4. The sampled population sizes were 48, 39, 67 respondents for the Oil and Gas companies (OG1,OG2 and OG3); 38, 52, 41, 28 respondents for the Construction companies (CC1, CC2, CC3 and CC4); and 73, 53, 68, 66 respondents for the Transportation and Logistics companies (TL1, TL2, TL3 and TL4), respectively and is limited to those in active service, whose years in length of service ranges from 5 to 20 years due to the qualitative nature of the study carried out. Figure 2 presents questionnaires

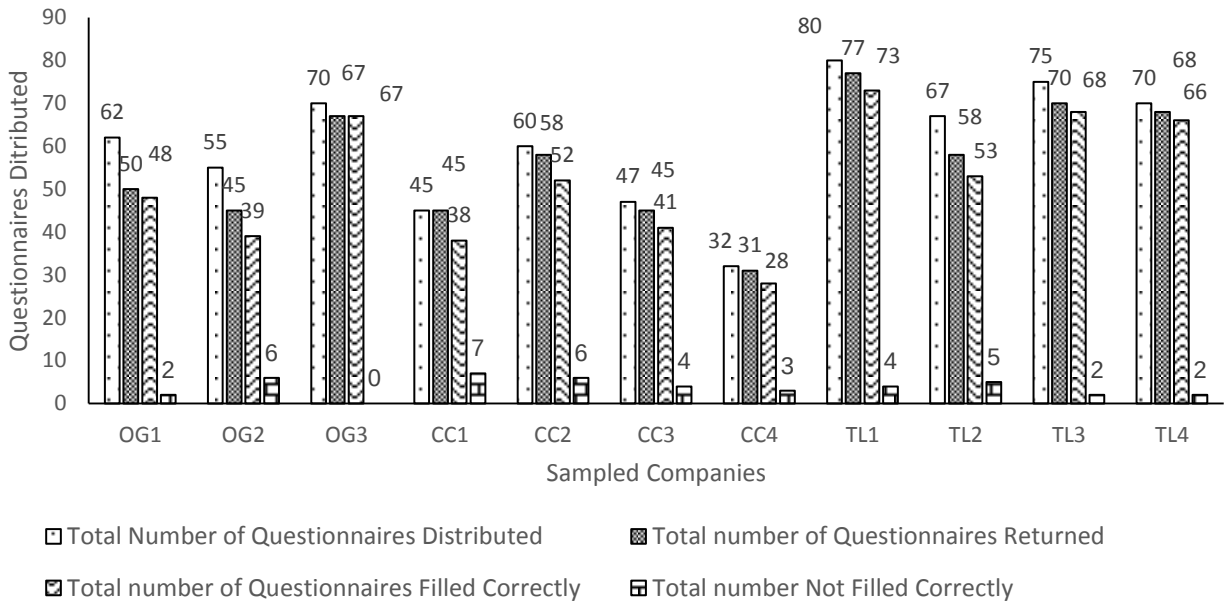


Figure 2. Questionnaires Distribution Statistic for the sampled population.

distribution statistics for the sampled population. The survey questions with respect to this study are close-ended questions. Sample of which is presented in Appendix A with SD, D, N, A and SA representing Strongly Disagree, Disagree, Undecided, Agree and Strongly Agree, respectively.

Data Analyses

The statistical package employed with respect to this study for data analysis was XLSTAT 2016, version 4.06. To determine the variance among the various groups of respondents in the eleven (11) sampled companies from the oil and gas, construction, transportation and logistics companies, the Friedman test was deployed. For k sample, the statistic of the Friedman test is calculated using Equation (1):

$$\hat{x}_R^2 = \left[\frac{12}{nk(k+1)} \sum_{i=1}^{k} R_i \right] - 3n(k+1) \qquad (1)$$

Note: The null hypothesis is to be rejected, when $\hat{x}_R > x^2_{k-1;\alpha}$

Where $\hat{x}_R$ =Friedman statistic; α = the difference to the mean of the group.

Multiple pairwise comparisons (Post-hoc) of responses within the various sampled groups (data sets) using Nemenyi's Procedure / Two-tailed test was also applied. Post-hoc tests are statistical tests used to find out which groups of data in a statistical analysis are significantly differed from one another from the differences arising from their mean rank group. It should be noted, that post–hoc tests are done after the completion of an analysis of variance (ANOVA) on an array or group of data using statistical tools such as the Friedman's test. Shapiro-Wilk test of normality was applied on the collected data sets for the determination of data type (Shapiro and Wilk, 1965). This was to aid choice of analytical process to be applied (parametric or non-parametric). Shapiro-Wilk test is premised on correlations between the sample group data and the matching normal scores. In other to find out whether a sample is from a non-normal distribution, the test for measure of power is involved. As the value of a test for normality is measured by its power, the Shapiro–Wilk test gives better clarity for power possession of data than any of the other statistical tools including the K-S test and the Lilliefors correction and is considered as the best choice in normality of data testing by some researchers (Ghasemi and Zahediasl, 2012).

Further analysis was carried out on the collected

Table 1. Friedman's test.

Q (Observed value)	221.1063
Q (Critical value)	5.9915
DF	2
p-value (Two-tailed)	< 0.0001
Alpha	0.05

Test interpretation:
H_0: The sampled come from the same population.
$H_{a:}$ The sampled do not come from the same population.
As the computed p-value is lower than the significance level alpha=0.05, one should reject the null hypothesis H_0, and accept the alternative hypothesis H_a. The risk to reject the null hypothesis H_0 while it is true is lower than 0.01%.

Table 2. Multiple pairwise comparisons using Nemenyi's procedure / Two-tailed test.

Sample	Frequency	Sum of ranks	Mean of ranks	Groups		
Construction	139	140.0000	1.0072	A		
Oil & Gas	139	314.5000	2.2626		B	
Transport Companies.	139	379.5000	2.7302			C

data set applying Principal Component Analysis (PCA). This was to identify the principal causes of injuries, illnesses and fatalities identified by the various respondents. Principal Component Analysis (PCA) is a statistical tool used to extract useful information from a set of data that are non-parametric in nature. PCA provides a basis for complex data reduction, simplification and filtration and as such helps to disclose certain important hidden information that otherwise would not have been known if left in its raw and unanalyzed state. The objective of PCA as a statistical tool in data analysis is to help identify basis for meaningful data re-expression and aid filtration of irrelevant and noisy information and reveal the most useful hidden data that will be impactful for decision making. The governing equation for Principal Component Analysis is presented by:

$$Z_j = a_{j1}F_1 + a_{j2}F_2 + a_{j3}F_3 + \ldots + a_{jn}F_n + u_jY_j \quad (j = 1, 2, 3, \ldots, n) \qquad (2)$$

The coefficients for the common factors also known as 'factor loading' is represented by 'a' in Equation (2). Where Z_j is an observed variable being described by the linear combination of common factors (F_1, F_2, F_3…, F_n) and U_jY_j represents a unique factor.

RESULTS

The output of Friedman's test is as shown in Table1, while Table 2 presents the summary of the output from the application of Multiple pairwise comparisons (Post-hoc) of responses within the various sampled groups (data sets) using Nemenyi's Procedure / Two-tailed. Also, Table 3 presents the summary of the test of significance on the various data sets (see Appendix B, Table B1). Figures 3 – 5 present the normal probability plot, an output from the normality test carried on the collected data set 1 (Oil and Gas Companies), 2 (Construction

Table 3. Significant differences.

Sampled Categories	Oil and Gas Companies	Construction Companies	Transportation/Logistic Companies
Oil and Gas	No	**Yes**	**Yes**
Construction	**Yes**	No	**Yes**
Transport Companies.	**Yes**	**Yes**	No

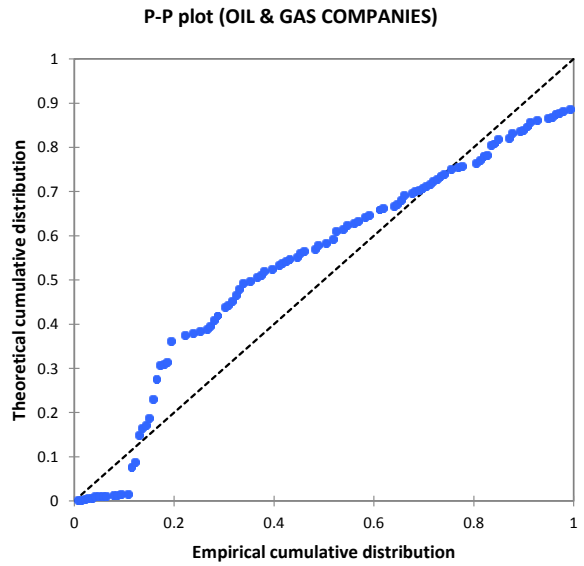


Figure 3. Normal p-p plot for data set with respect to Oil and Gas companies.

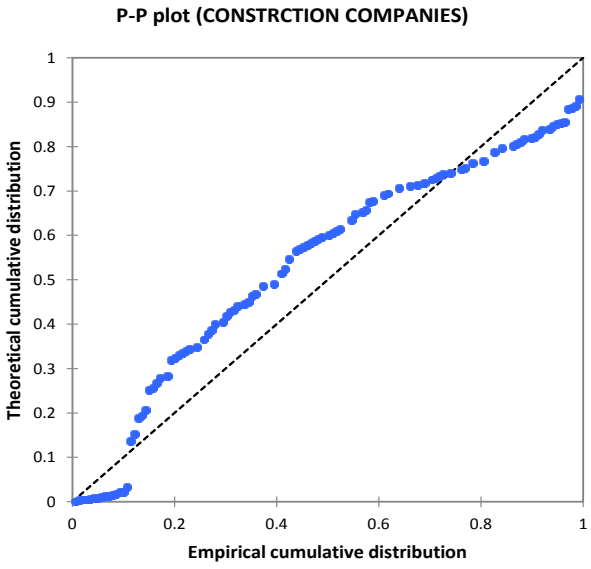


Figure 4. Normal p-p plot for data set with respect to Construction companies.

Figure 5. Normal p-p plot for data set with respect to Transportation and Logistics companies.

Companies), and 3 (Transportation and Logistics Companies) (see Appendix B, Tables B2-B4). On application of PCA on the collected data sets, Figures 6, 7 and 8 present the output with respect to the biplot of the observed variables (Questionnaire parameters) and factors after Varimax Rotation for sampled Oil and Gas, Construction and Transportation/Logistics Companies, respectively. While Table 4 presents the summary of the extracted factors (D1 and D2) with respect to the major general causes of illness, injuries and fatalities as identified after varimax rotation. See (Appendix C). From the collected data sets, Figures 9, 10 and 11 present the average awareness on the general causes of workplace injuries, illness and fatalities.

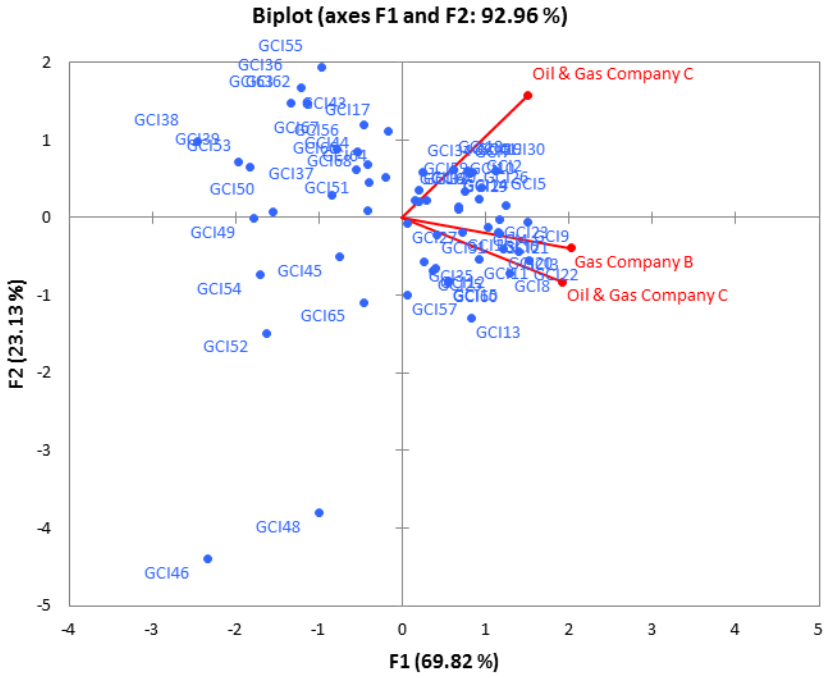


Figure 6. Biplot of extracted factors on the observed variables (Questionnaire parameters) and factors after Varimax Rotation for Sampled Oil and Gas Companies.

DISCUSSION

The Friedman's test applied on the collected data sets revealed that the data sets are from different sampled populations, this is further confirmed by the multiple pairwise comparison (post – hoc) using Nemenyi's Procedure on the data sets. This implies that there is a significant difference between the sampled group with respect to the awareness of the causes of occupational illness, injuries and fatalities (see Table 3). Figures 3, 4 and 5 are the normal probability plots of the collected data sets. The Normal p-p plot according to Chambers et al. (1983) is a graphical technique for assessing whether or not a data set is approximately normally distributed. The data are plotted against a theoretical normal distribution in such a way that the points should form an approximate straight line but this is not so for the three plots. Thus, the data sets were non-parametric in nature and require a non-parametric data analytical approach. The PCA was applied to extract vital and useful information from the set of sixty-nine (69) general causes of injuries, illnesses and fatalities parameters that were non-parametric in nature from each sector of the companies studied (see, Figures 6, 7, and 8). A total of 6 parameters were extracted from the 69 parameters examined as causes of accidents in the workplace. In the various sectors of the industry studied, two (2) parameters each, were identified in the Oil and Gas industry, the construction sector and the transportation and logistics companies (see Table 4). Furthermore, after Varimax rotation, the contributions of the variabilities in the 3 distinct sectors studied, showed that in the oil and gas sector, D1 and D2 were responsible for 57.3% and 35.7%, respectively of the total variance recorded, for the Construction sector, D1 and D2 were responsible for 54.2% and 29.7% respectively of total variance recorded in the studied companies while D1 and D2 accounted for 38.0% and 29.7 %, respectively of the total variance recorded in the transportation and logistics companies (see Appendix C).

Out of the sampled respondents in the Oil and Gas companies, it was discovered that there is a very high awareness of the general causes of injuries, Illnesses and fatalities in the workplace. This high awareness, explains the low level of injuries, illnesses and fatality cases recorded periodically in such occupational sectors of the

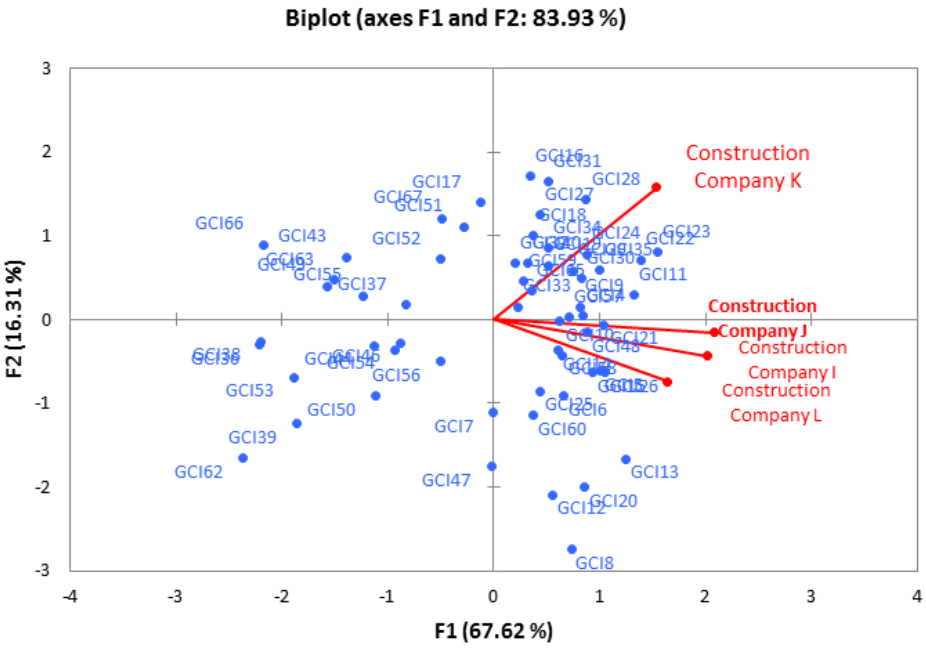


Figure 7. Biplot of extracted factors on the observed variables (Questionnaire parameters) and factors after Varimax Rotation for Sampled Construction Companies.

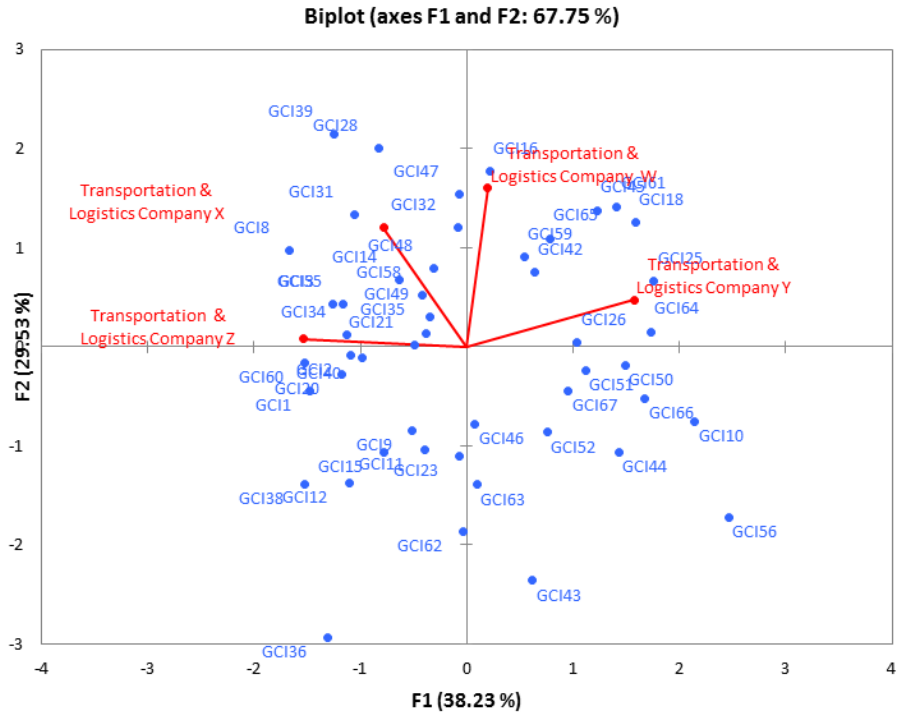
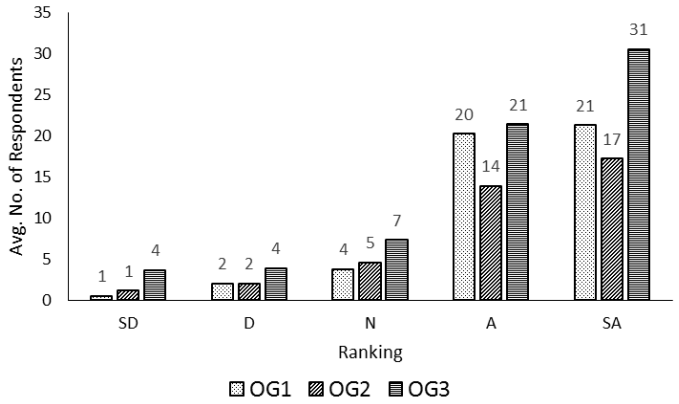


Figure 8. Biplot of extracted factors on the observed variables (Questionnaire parameters) and factors for sampled Transportation and Logistics Companies.

Table 4. Summary of the extracted factors (D1 and D2) with respect to the major general causes of illness, injuries and fatalities as identified after varimax rotation.

Companies	Extracted Factors After Varimax Rotation	General Causes of Injuries, Illnesses and Fatalities
Oil and Gas	D1	Poor/inadequate hazards identification and reporting can lead to injuries occurring in the workplace.
	D2	Occupational diseases or illnesses are caused by abnormal conditions or disorders linked to employment.
Construction	D1	High risk tolerance and over confidence on assigned tasks causes accidents and injuries.
	D2	Fatality is death resulting from an accident or disaster.
Transportation/ Logistics	D1	In my place of work, a system does not exists to ensure personnel assigned to perform tasks are suitable and competent.
	D2	Non-provision/inadequate tools to perform assigned task is identified as a cause of injuries in the workplace.



Note: *SD, D, N, A and SA represents Strongly Disagree, Disagree, Undecided, Agree and Strongly Agree, respectively*

Figure 9. Average Respondents Awareness Ranking on the General Causes of Injuries, Illnesses and Fatalities for Sampled Oil and Gas Companies.

economy as people are very much aware of what can harm them in the industry. Although, the level of awareness among the workforce in the sampled oil and gas companies is not the same, the reason for these differences, is attributable to the geographic spread and area of operations of these companies. Some of the companies have more of their operations in deep seas which limit access to a larger number of the workforce, while some operate mostly on swamps, shallow waters and lands where there are more contacts with people from different spreads and the immediate community (see Figure 9). On the Construction companies sampled, respondents from the various companies have a very high level of understanding with regards to the general causes of injuries, illnesses and fatalities in the workplace. The reason may not be unconnected with the fact, that majority of their employees were former contractors to notable oil and gas companies operating in their area of operation. However, like the oil and gas industries the level of awareness on the causes of injuries, differs from company to company and are not at par with one another and are lower with that of the workforce in the oil and gas industries (see Figure 10).

The transportation and logistics companies' employee respondents gave an alarming and worrisome information on the total lack of knowledge of the general causes of injuries, illnesses and fatalities. This perhaps explains the

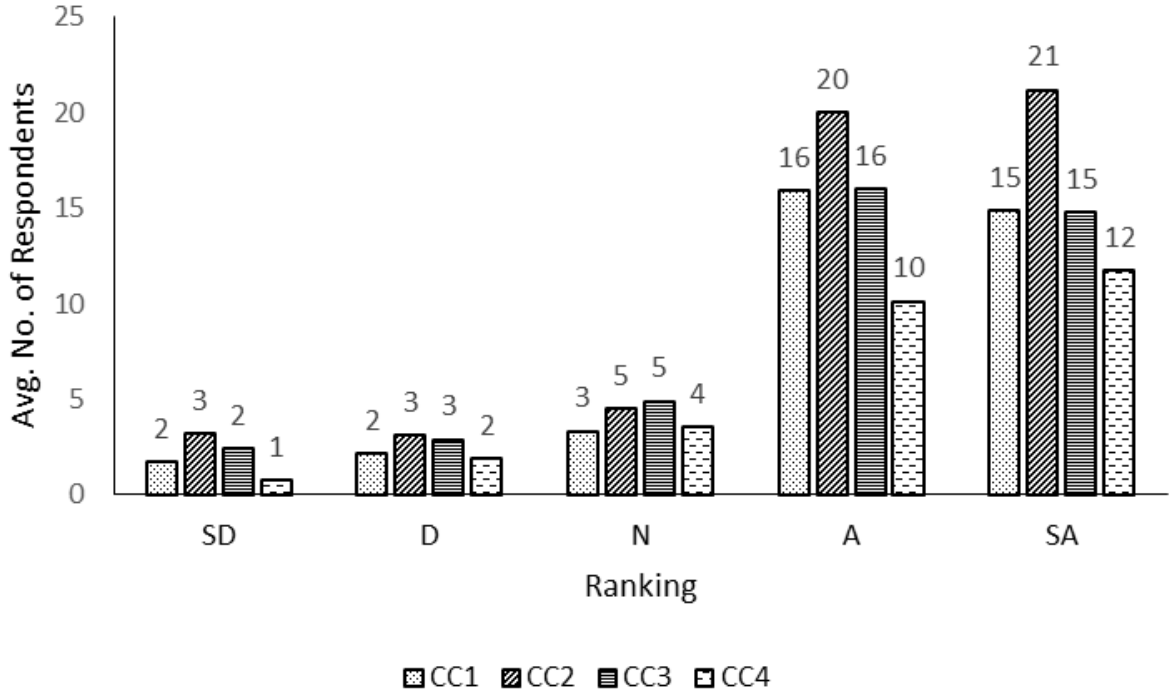


Figure 10. Average Respondents Awareness Ranking on the General Causes of Injuries, Illnesses and Fatalities for Sampled Construction Companies.

very high rate of accidents, injuries, illnesses and fatalities recorded on daily basis in that sector (WHO, 2009). Out of the four transportation and logistics firms sampled, the employees of transportation and logistics Company TL3, have more knowledge of the general causes of injuries, illnesses and fatalities in the workplace, followed by company TL1, company Tl4 and finally by transportation and logistics company TL2. A very dangerous trend discovered during the course of this study in the transport and logistics sector, is the inability of their workforce to decide in strong terms, parameters that can cause incidents in the workplace. Majority of their responses fell on the neutral scale as they are neither sure nor able to categorically firm up on such factors that cannot cause bodily harm, illness and fatality in the cause of discharge of their assigned responsibilities. The reason for this may not be unconnected with the high level of illiteracy discovered among the number of respondents interviewed in the transportation and logistics sector. A great number of them are either secondary school drop-outs, attended primary or never attended any form of school from birth (see Figure 11).

CONCLUSION

The conclusion drawn from the study includes the following:

i.) This study shows that the level of awareness of the workforce on the general causes of accidents, illnesses and fatalities, is higher in the oil and gas industries than the construction industries and the transportation and logistics industry. However, the level of workforce awareness on the causes of injuries, illnesses and fatalities in the construction industries, are higher than that found among the workforce of the transportation and logistics industries.

ii.) The parameters causing frequent occurrence of occupational injuries, illness and fatalities in the oil and gas industries as identified from PCA include poor/inadequate hazards identification and reporting.

iii.) The parameters identified as the major causes of frequent occurrence of occupational injuries, illness and fatalities in the Construction industries, include high risk tolerance and over confidence by workers on assigned tasks; and

iv.) Finally, the parameters causing frequent

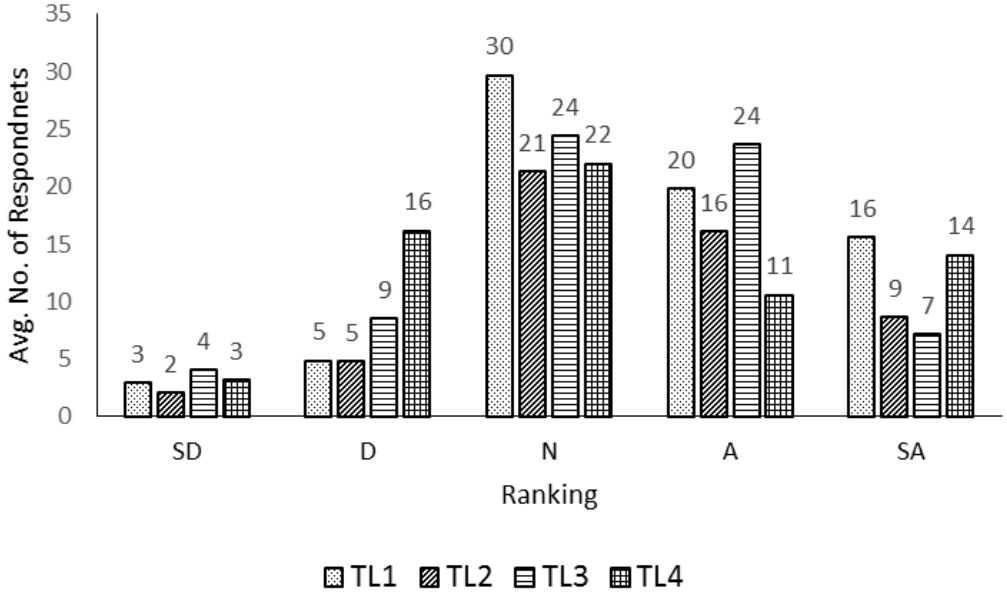


Figure 11: Average Respondents Awareness Ranking on the General Causes of Injuries, Illnesses and Fatalities for Sampled Transportation and Logistics Companies.

occurrence of occupational injuries, illness and fatalities in the transportation and logistics industries as identified from PCA, include the non-existence of a system to ensure personnel assigned to perform tasks are suitable and competent and the non-provision of adequate tools to perform assigned task.

RECOMMENDATION

Information collated and analyzed in the present study has shown that the level of workforce awareness from company to company differs. However, due cognizance has been noted that the level of awareness of injury, illness and fatality causatives is very poor in the transportation and logistics companies as compared to the construction, oil and gas companies. Based on the aforementioned, it is recommended that:

i.) Awareness and enlightenment of people and the workforce on hazards identification, injuries, illnesses and fatalities control and prevention measures should be put in place and strengthened. This could be achieved through enhanced training on key hazard identification and prevention subjects, on-the-job training on use of procedures, safework practices, permits to work, job safety analysis and so on. This should be done to enhance workforce competencies while on and off the job.

ii.) Efforts should be geared towards the construction, transportation and logistics companies, where the level of awareness is low as compared to the oil and gas industries where every worker employed and through training has adequate awareness of what constitutes a hazard, how to identify them, mitigation and reporting requirements of the workplace.

iii.) Plans should be put in place by the management of various companies to reduce occupational diseases and illnesses linked to employment.

iv.) High risk tolerance and over confidence on assigned tasks that cause incidents should be identified early enough and addressed and mitigations put in place prior to embarking on any assignment. Also, systems should be put in place to ensure personnel assigned to perform tasks are suitable and competent.

v.) Non-provision/inadequate tools to perform assigned task is identified as a cause of injuries in the workplace. Therefore, adequate provisions should be put in place to provide the needed tools to ensure an incident and harm free environment.

COMPETING INTERESTS

The authors of this article have declared that no competing interests exist while in the course of preparing this document.

REFERENCES

Ajayi PA and Okegbemiro SA (1998). Accident and Injury Pattern in Oil and Gas Exploration and Production – A Two Year. Society of Petroleum Engineers International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production, Caracas, Venezuela. Available at: https://www.onepetro.org/conference-paper/SPE-46787-MS,(Accessed 10/2/2015). Association, 34(205): 109.

Chambers JM, Cleveland WS, Kleiner B and Tukey PA (1983). Graphical Methods for Data Analysis. Boston, Duxbury Press.

Ezenwa AO (1996). Studies of Risks Associated with Technological Development in Nigeria. J. Roy. Soc. Health, 116(6):376-380.

Ezenwa AO (2001). A Study of Fatal Injuries in Nigerian Factories. Soc. Occupat. Med., 51(8):485-489.

Federal Road Safety Corps (FRSC) (2012). Nigeria Road Safety Strategy (NRSS). 2012- 2016.

Friedman M (1939). A Correction: The use of Ranks to Avoid the Assumption of Normality Implicit in the Analysis of Variance. J. Am. Statistical.

Ghasemi A and Zahediasl S (2012). Normality Test for Statistical Analysis - A Guide for Non-Statisticians. Int. J. Endocrinol. Metab., 10(2):486-489. Available at: http://sci2s.ugr.es/keel/pdf/algorithm/articulo/sharpiro1965.pdf

Jain RK and Rao SS (2014). Industrial Safety, Health and Environment Management Systems. Reprinted 3rd Edition. Khanna Publishers. New Delhi. India.

Nwaogazie IL (2011). Probability and Statistics for Science and Engineering Practice. De-Adroit Innovation, Enugu. Nigeria.

Nwaogazie IL and Ekwemuka JN (2015). Assessment of Workplace Stressors in Oil and Gas Companies in Port Harcourt. Int'l J. Current Adv. Research. 3 (8). Available at : http://www.journalijcar.org

Nwaogazie IL, Omuruka CT and Adaramola SS (2016). Work-Related Musculoskeletal Disorders: A Case of Office-Based Civil Servants in Rivers State, Nigeria, International Journal of Tropical Disease and Health. 18 (1): 1-13. Available at: www.sciencedomain.org

Okoye PU (2016). Improving the Safety Performance of Nigeria Construction Workers: A Social Ecological Approach. Univ. J. Eng. Sci., 4(2): 22-37.

Shapiro SS and Wilk MB (1965). An Analysis of Variance test for Normality (Complete Samples). Boimetrika. 52(3 and 4): 591-611.

Stratfor (2012). www.stratfor.com

Sumaila AG (2013). Road Crashes Trends and Safety Management in Nigeria. Journal of Geography and Regional Planning. 6(3):53-62.

Valentic D, Stojanovic D and Micovic V (2005). Work Related Diseases and Injuries on an Oil Rig. Int. Marit. Health. 2005(56): 1-4

World Bank (2016). Gross Domestic Product Ranking Table -2104, Washington. Available at: http://databank.org/data/download/ GDP.pdf.

World Health Organization (2009). Global Status Report on Road Safety.

APPENDIX A

Table 1. Sample of Questionnaire Administered.

Awareness on the Causes of Injuries, Illnesses and Fatalities						
S/N	Parameter Description	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
General Causes of Injuries, Illnesses and Fatalities						
1.	Hazards are the main causes of injuries, illnesses and fatalities	○	○	○	○	○
2.	Hazards that can cause harm are classified into different categories.	○	○	○	○	○
3.	Apart from hazards, other factors such as carelessness can cause injuries, illnesses and fatalities.	○	○	○	○	○
4.	Unsafe acts and conditions including poor machine designs can cause accidents, injuries, illnesses and fatalities.	○	○	○	○	○
5.	Hazards exist in my place of work.	○	○	○	○	○
6.	Injuries, illnesses and fatalities can occur at the workplace as a result of my actions and inactions.	○	○	○	○	○
	Occupational Injuries					
7.	An occupational injury is any injury from a cut, fracture, sprain or amputation from workplace exposures.	○	○	○	○	○
	Causes of Occupational Injuries					
	Personnel factors	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
8.	Operator error/ carelessness on human machine interface systems can cause injuries in the workplace.	○	○	○	○	○
9.	Distraction, anger, excitement, shortcuts can lead to injuries.	○	○	○	○	○
10.	Repetitive tasks not coupled with frequent breaks can cause injuries	○	○	○	○	○
11.	Poor/inadequate hazards identification and reporting can lead to injuries occurring in the workplace.	○	○	○	○	○
12.	Neglect to close identified and reported hazards can cause injuries in the workplace.	○	○	○	○	○
13.	Over-exertion, lifting, pushing, pulling, slippery surfaces, throwing objects from heights can lead to injuries in the workplace.	○	○	○	○	○
14.	Horse plays can cause injuries in the workplace	○	○	○	○	○
15.	Placing people on jobs of which they are not competent to do can lead to injuries.	○	○	○	○	○

Table 1. Contd.

16.	In my place of work, a system exists to ensure personnel assigned to perform tasks are suitable and competent.	○	○	○	○	○
17.	Insufficient personnel to execute tasks in any work location can lead to accidents and injuries.	○	○	○	○	○
18.	Complacency is a major cause of injuries	○	○	○	○	○
19.	High risk tolerance and over confidence on assigned tasks causes accidents and injuries.	○	○	○	○	○
20.	Alcohol and drugs consumption can cause injuries in the workplace.	○	○	○	○	○
	Job factors	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
21.	Fatigue from working long hours can cause injuries.	○	○	○	○	○
22.	Stress, excessive extended work hours, irregular shift schedules/handovers, collision, slips, trips and falls leads to injuries.	○	○	○	○	○
23.	System, procedure and process changes not communicated to workers can lead to injuries	○	○	○	○	○
24.	Absence of simultaneous operations (SIMOPS) reviews to ensure no conflicting tasks run concurrently may lead to accidents and injuries.	○	○	○	○	○
25.	Injuries can occur as a result of inadequate or absence of procedures to execute task.	○	○	○	○	○
26.	Not carrying out risk assessment on major tasks can lead to injuries.	○	○	○	○	○
27.	Risk assessments, screening and planning meetings are held prior to any project execution in my workplace.	○	○	○	○	○
28.	Tool Box Talks are held prior to commencement of tasks in my place of work.	○	○	○	○	○
29.	Not sharing lessons learned from previous incidents is a major cause of repeated injuries	○	○	○	○	○
30.	Inadequate training on hazard identification can cause personnel injuries	○	○	○	○	○
31.	Lack of on the job training, coaching, mentoring and refresher courses, leads to accidents and injuries.	○	○	○	○	○
32.	Over pressure by management to meet and exceed set targets cause injuries	○	○	○	○	○
33.	Placing production priorities over safety values is a major cause of injuries.	○	○	○	○	○
34.	Absence of periodic safety reviews, audits, inspection of worksites, tools and equipment is a major cause of injuries.	○	○	○	○	○
35.	Poor-housekeeping can cause injuries.	○	○	○	○	○

Table 1. Contd.

36.	Lack of Incentives, motivation and recognition for good safety practices can cause injuries.	○	○	○	○	○
37.	Poor Management commitment to safety is a major cause of accidents and injuries in my workplace.	○	○	○	○	○
38.	I am aware of the industrial sector with the highest worker injury rate in Nigeria.	○	○	○	○	○
39.	I am aware of the most impacted and injured part of the body when an accident occur.	○	○	○	○	○
	Equipment factors	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
40.	Non-provision/inadequate tools to perform assigned task is identified as a cause of injuries in the workplace.	○	○	○	○	○
41.	Poor Ventilation and lightening can lead to injuries.	○	○	○	○	○
42.	Non-provision or inadequate supply of Personal Protective Equipment is a major cause of injuries.	○	○	○	○	○
43.	Poor planned equipment maintenance program is responsible for most injuries in the workplace.	○	○	○	○	○
44.	In Nigeria, motor vehicle traffic crashes are the leading cause of injuries and fatalities.	○	○	○	○	○
	Environmental factors					
45.	Poor/harsh weather conditions, cramped work environment, high noise levels, access and egress inadequacies lead to injuries.	○	○	○	○	○
	Occupational Illnesses	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
46.	Occupational diseases or illnesses are caused by abnormal conditions or disorders linked to employment.	○	○	○	○	○
	Causes of Occupational Illnesses					
	Personnel factors					
47.	Acute or chronic illnesses or diseases enter into the human body through inhalation, absorption, ingestion, direct contact and injection.	○	○	○	○	○
48.	Exposure to biological hazards and chemical fumes causes occupational diseases and illness.	○	○	○	○	○
49.	The leading causes of occupational illnesses are sprains and strains.	○	○	○	○	○
	Job factors	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
50.	The most prevalent illness in the workplace is musculoskeletal disorder.	○	○	○	○	○
51.	Musculoskeletal disorders, skin diseases, noise induced hearing loss and respiratory disorders are types of occupational illnesses.	○	○	○	○	○

Table 1. Contd.

52.	Pneumoconiosis is a fibrotic lung disease caused by the inhalation of dust particles.	○	○	○	○	○
53.	Carpel tunnel syndrome is the most disabling type of injury or illness.	○	○	○	○	○
54.	The most prevalent illness in the workplace is musculoskeletal disorder.	○	○	○	○	○
55.	Silicosis is an acute or chronic lung disease caused by free crystalline silica inhalation.	○	○	○	○	○
56.	A major cause of illnesses and fatalities is absence of management commitment to safety.	○	○	○	○	○
	Equipment factors					
57.	Improperly maintained work equipment can cause and aggravate musculoskeletal disorders.	○	○	○	○	○
	Environmental factors					
58.	Dirty environment and poor hygiene practices can lead to illnesses and diseases	○	○	○	○	○
59.	Fatality is death resulting from an accident or disaster.	○	○	○	○	○
	Causes of Fatalities					
	Personnel factors					
60.	There are fatal and non-fatal injuries attributed to human errors	○	○	○	○	○
61.	Carelessness on the part of individuals in the workplace can lead to fatalities	○	○	○	○	○
	Job factors	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
62.	Falls are the leading cause of fatal and non-fatal injuries among the workforce.	○	○	○	○	○
63.	Highway incidents or transportation related failures are responsible for increased number of workforce deaths	○	○	○	○	○
64.	Most fatal losses are as a result of poor emergency medical response timing	○	○	○	○	○
65.	Being struck by an object has a great potential of causing fatality	○	○	○	○	○
66.	Explosions and fires in the workplace are leading cause of fatalities	○	○	○	○	○
	Equipment factors					
67.	Contact with objects including electrocution is identified as leading cause of fatalities.	○	○	○	○	○
68.	Equipment failures and poor preventive/ routine maintenance culture is a major cause of most fatalities in the workplace	○	○	○	○	○
	Environmental factors					
69.	Working under adverse and inclement weather condition can lead to fatalities	○	○	○	○	○

APPENDIX B

Table B1. Table of pairwise differences.

Sample	Oil & Gas Companies	Construction Companies	Transport Companies
Oil & Gas	1	**< 0.0001**	**0.0003**
Construction	**< 0.0001**	1	**< 0.0001**
Transport Companies	**0.0003**	**< 0.0001**	1

Table B2. Shapiro-Wilk test (OIL and GAS COMPANIES).

W	0.8451
p-value (Two-ailed)	< 0.0001
Alpha	0.05

Test interpretation:

H_0: The variable from which the sample was extracted follows a Normal distribution.

H_a: The variable from which the sample was extracted does not follow a Normal distribution.

As the computed p-value is lower than the significance level alpha=0.05, one should reject the null hypothesis H_0, and accept the alternative hypothesis H_a. The risk to reject the null hypothesis H0 while it is true is lower than 0.01%.

Table B3. Shapiro-Wilk test (CONSTRUCTION COMPANIES).

W	0.8492
p-value (Two-tailed)	< 0.0001
alpha	0.05

Test interpretation:

H_0: The variable from which the sample was extracted follows a Normal distribution.

H_a: The variable from which the sample was extracted does not follow a Normal distribution.

As the computed p-value is lower than the significance level alpha=0.05, one should reject the null hypothesis H_0, and accept the alternative hypothesis H_a. The risk to reject the null hypothesis H0 while it is true is lower than 0.01%.

Table B4. Shapiro-Wilk test (TRANSPORT COMPANIES).

W	0.5531
p-value (Two-tailed)	< 0.0001
alpha	0.05

Test interpretation:

H_0: The variable from which the sample was extracted follows a Normal distribution.

H_a: The variable from which the sample was extracted does not follow a Normal distribution.

As the computed p-value is lower than the significance level alpha=0.05, one should reject the null hypothesis H_0, and accept the alternative hypothesis H_a. The risk to reject the null hypothesis H_0 while it is true is lower than 0.01%.

APPENDIX C

PCA Outcome for Identification of Major Factors with respect to Causes of Injuries, Illnesses and Fatalities in Sampled Oil and Gas companies

Table C1. Kaiser-Meyer-Olkin measure of sampling adequacy (Oil and Gas Companies).

Oil and Gas Company, OG1	0.5710
Oil and Gas Company, OG2	0.5548
Oil and Gas Company, OG3	0.7378
KMO	0.5885

Table C2. Variability of Resultant Factors from PCA analysis.

	F1	**F2**	**F3**
Eigenvalue	2.0947	0.6940	0.2113
Variability (%)	69.8238	23.1320	7.0442
Cumulative %	69.8238	92.9558	100.0000

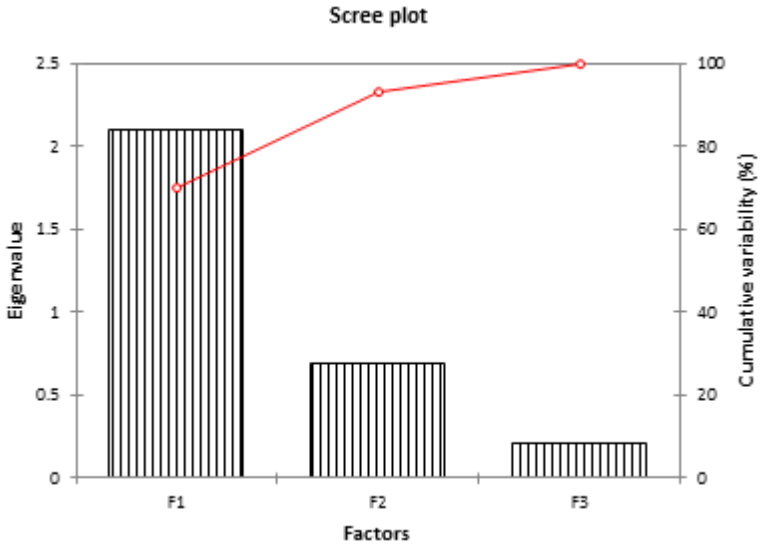


Figure C1. Scree plot of extracted factors (F1 and F2) for sampled Oil and Gas Companies.

Table C3. Percentage variance of extracted factors after Varimax rotation.

	D1	D2	F3
Variability (%)	57.2946	35.6612	7.0442
Cumulative %	57.2946	92.9558	100.0000

Table C4. Correlations between variables and factors after Varimax rotation.

	D1	D2
Oil and Gas Company, OG1	0.9451	0.1288
Oil and Gas Company, OG2	0.8822	0.3256
Oil and Gas Company, OG3	0.2175	0.9733

PCA Outcome for Identification of Major Factors with respect to Causes of Injuries, Illnesses and Fatalities in Sampled Construction Companies

Table C5. Kaiser-Meyer-Olkin measure of sampling adequacy (Construction Companies).

Construction Company, CC1	0.9388
Construction Company, CC2	0.6202
Construction Company, CC3	0.7891
Construction Company, CC4	0.6291
KMO	0.6877

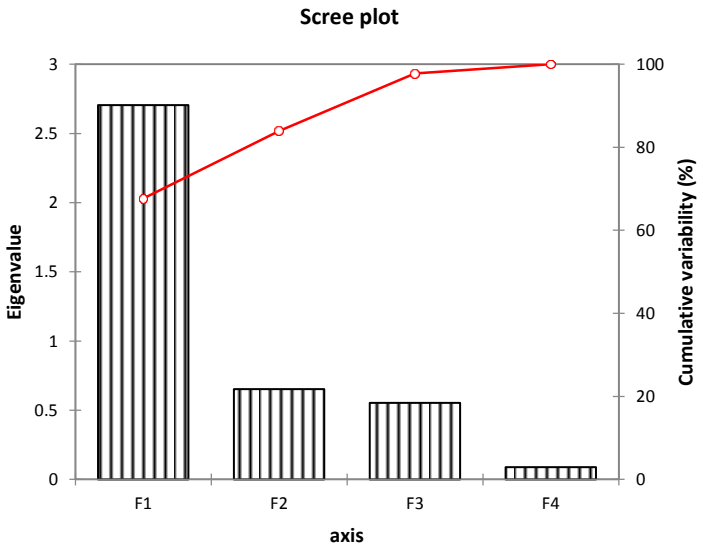


Figure C2. Scree plot of extracted factors (F1 and F2) for Sampled Construction Companies.

Table C6. Percentage variance of extracted factors after Varimax rotation.

	D1	D2	F3	F4
Variability (%)	54.2253	29.7036	13.8374	2.2337
Cumulative %	54.2253	83.9289	97.7663	100.0000

Table C7. Correlations between variables and factors after Varimax rotation.

	D1	D2
Construction Company, CC1	0.8019	0.0895
Construction Company, CC2	0.8380	0.4179
Construction Company, CC3	0.2310	0.9587
Construction Company, CC4	0.8777	0.2941

PCA Outcome for Identification of Major Factors with respect to Causes of Injuries, Illnesses and Fatalities in sampled Transportation and Logistics Companies

Table C8. Kaiser-Meyer-Olkin Measure of Sampling Adequacy (Transportation and Logistics Companies).

Transportation and Logistics Company, TL1	0.3735
Transportation and Logistics Company, TL2	0.5496
Transportation and Logistics Company, TL3	0.4819
Transportation and Logistics Company, TL4	0.5061
KMO	0.4828

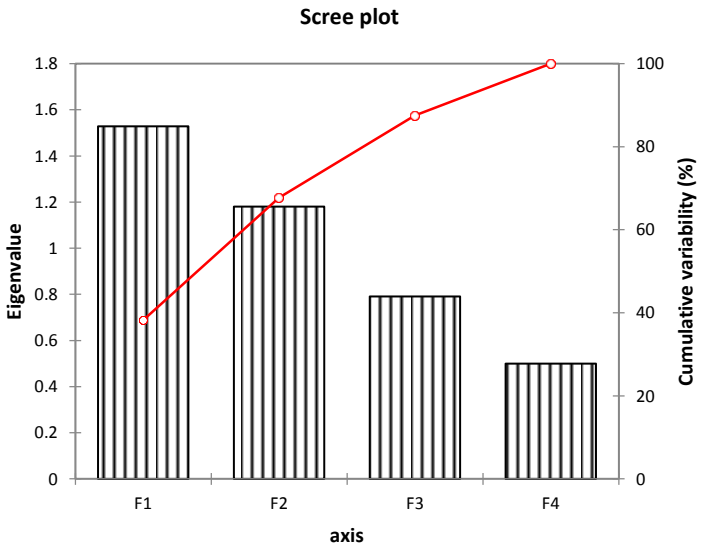


Figure C3. Scree plot of extracted factors (F1 and F2) for sampled transportation and logistics Companies.

Table C9. Percentage variance of extracted factors after Varimax rotation.

	D1	D2	F3	F4
Variability (%)	38.0374	29.7156	19.7740	12.4730
Cumulative %	38.0374	67.7530	87.5270	100.0000

Table C10. Correlations between variables and factors after Varimax rotation.

	D1	D2
Transportation and Logistics Company, TL1	-0.2274	0.8228
Transportation and Logistics Company, TL2	0.3157	0.6859
Transportation and Logistics Company, TL3	-0.8586	0.1239
Transportation and Logistics Company, TL4	0.7955	0.1605