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Analysis of Safety Performance in Selected Oil and Gas Companies in Port Harcourt, Rivers State, Nigeria

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Abstract: **The study was aimed at evaluating the levels of Safety performance of selected companies in the Oil and Gas companies in Nigeria. A Likert-styled questionnaire was used to gather information from respondents in Upstream, downstream and servicing companies in Port Harcourt, Rivers state. A total of six hundred and sixty (660) copies of questionnaire were distributed to the sample population out of which six hundred and fifty one (651) were returned, representing 98% response rate. Eleven (11) of the returned questionnaire was voided. A total of six hundred and forty (640) valid questionnaires were used for analysis. The result indicated that there was Safety consciousness amongst the workforce in the three sectors, and the level of Safety Awareness in the upstream sector is higher. Management in the upstream sector had 96% commitment, the servicing sector 91% and 67% in the downstream sector. An ANOVA on safety management system gave a *p*-value of <0.001 signifying that the difference in the implementation of Safety Management System (SMS) in the three sectors is statistical significant. Kendall *W* coefficient statistics result showed the *w*-value of the upstream sector at 0.735 with 74% concordance, downstream sector, 0.767 with 77% concordance and servicing sector, 0.702 with 70% concordance. The study therefore recommended that the downstream and servicing sectors management should improve on their safety commitment; personnel motivation awards and safety awareness programs to enhance better safety performance.**

Keywords: **Oil and Gas companies, Management System, servicing sector, safety performance, Port Harcourt.**

1. INTRODUCTION

The Nigerian oil and gas industry has been very active since crude oil was founded in Olobiri in the 50s by the Shell Group. However, the industry has for so long been largely dominated by multinational corporations not until the beginning part of the 1990s when indigenous companies began to make a foray into the industry (Adewale, 2014).

The oil and gas industry in Nigeria is subdivided into three sectors which work interdependently to ensure operations and other activities leading to the consumption of petroleum products, which are carried out safely and effectively (Antonio 2013). The sectors include upstream, servicing and downstream sectors. The scope of activities for the upstream sector includes exploration and production of oil and gas products (Omenikolo, 2010). In Nigeria, the upstream sector is predominantly dominated by international oil companies (IOCs). The Downstream sector of the industry is responsible for the refining of petroleum products and distribution to the final consumers. This sector has three main functional areas; refining, distribution and marketing of petroleum products (Obasi, 2003). Servicing sector comprises of companies both indigenous and international that provides support services to upstream and downstream companies ranging from fabrication, engineering procurement, Construction, Front End Engineering Design (FEED), Conceptual designs, Seismic Studies, drilling support, waste treatment etc. (Omenikolo, 2010).

Health and Safety issues are of high priority in the Nigeria oil and gas industry as they are germane to the sectors success. According to Monday (2013), the oil and gas industry is one of the riskiest industries when it comes to health and safety of employees and is laden with a wide range of hazards which if not properly and effectively managed could have

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disastrous and devastating effects on the employees, the environment, company reputation and the economy . The overall impact of injuries and illnesses from workers on a company's overhead is capital intensive when both the direct and indirect costs are considered. Employees are not the sole recipient of the negative effect of workplace injuries. The employers also face serious repercussions, especially if the injury or accidents were due to some form of company negligence. One of the great concerns of the workplace injury is the litigation a company will suffer. A company can, for instance, be seriously negatively affected if they do not implement worker's compensation. It is important therefore for organization to put modalities in place to avoid the possible repercussions arising from workplace injuries.

Several researchers like Waqas (2014) and Alberta (2015) have opined that an effective implementation of a safety management system is proactive tool to prevent not only injuries and illnesses in the workplace, it will also minimize both the frequency and the seriousness of workplace incidents / injuries and will demonstrate an organization due diligence and duty of care in the event that an incident does occur but cannot guarantee total elimination of workplace incidents. However, this study seeks to assess and compare the level of safety awareness, employee's perception of company's safety performance, implementation of safety management and management commitment in ensuring safety of workers and safe working environment across selected companies in the three sectors of the Nigerian oil and gas industry in Port Harcourt, Rivers state.

2. MATERIALS AND METHOD

2.1 Study Area:

This study was carried out in selected Upstream, Downstream and Servicing companies in Rivers State. Port Harcourt is the largest city and capital of Rivers State and is located in the Southern part of Nigeria. It lies geographically along longitude 4°49'27" N and latitude 7°2'1"E of the Equator and has a total area of 360km²(140sq mi) [Goggle Map, 2016]. The state is bound on the southern part by the Atlantic Ocean, to the northern part by Eastern States, like Anambra, Abia and Imo, Eastern part by Akwa Ibom State and Western part by Bayelsa and Delta States.

Port Harcourt is one of the Oil and Gas City of Nigeria and a major business hub with a population of about 1,382,592 (Census, 2006). Its massive growth in population can be primarily attributed to the influx of people from surrounding cities and states for crude oil exploration and production, petroleum refining, construction, transportation, and other commercial activities.

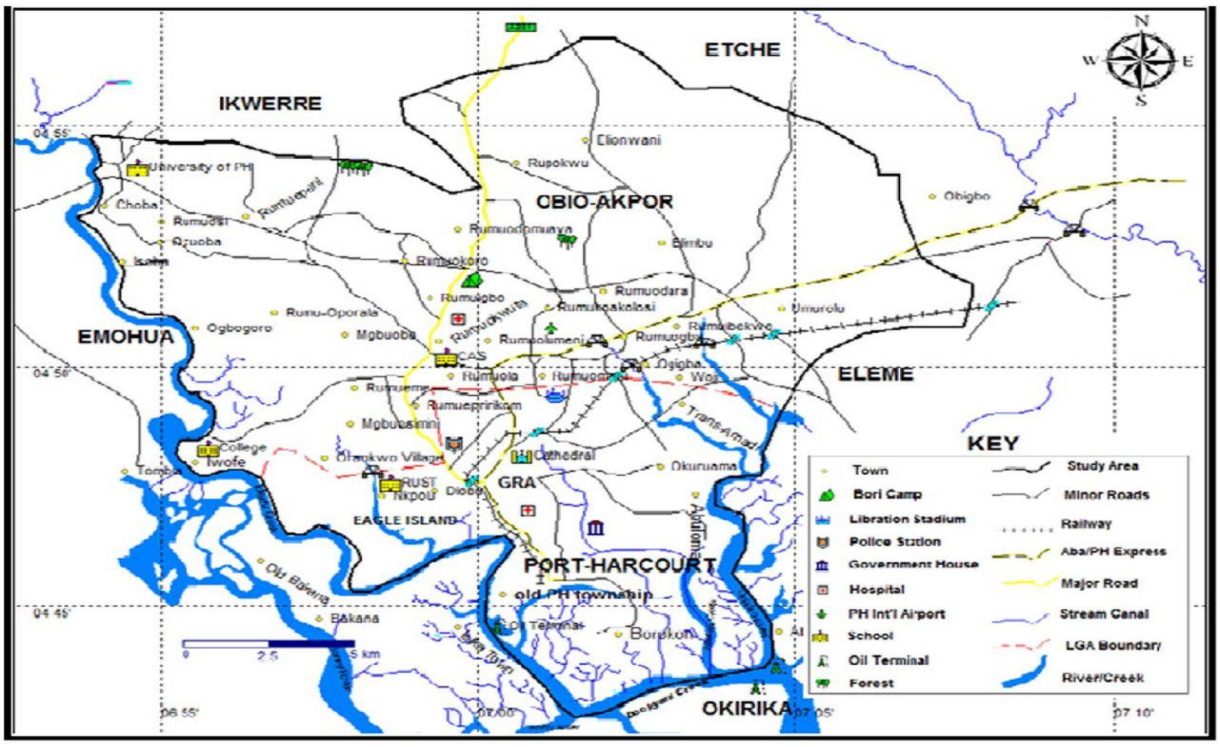

Figure 1: Map of study area (Rivers state showing Port Harcourt and environs)

2.2 Study population:

The study population for this study comprised of workers in the upstream, downstream and midstream sectors of the oil and gas industry in Nigeria. Companies were selected randomly from the three (3) sectors. However, the simple random sampling technique was adopted for the selection of respondents from the selected companies in the upstream, midstream and downstream sectors respectively.

2.3 Sample Size Estimation:

The sample size for this study was determined using the prevalence formula (Nwagozie, 2016) below;-

$$n = \frac{Z^2 \, x \, SD \, x \, (1-SD)}{e^2} \qquad 2.1$$

Where: Z = Z-score at 95% Confidence level = 1.96

Std = Standard Deviation = 0.12

e = Margin of error = 0.05

n = Sample size.

A total of 660 questionnaires were distributed to the selected companies. 220 questionnaires were distributed to the upstream companies, 200 questionnaires to Downstream and 240 questionnaires were distributed to Servicing companies.

2.4 Data Collection:

Data collection included the sampling of the target population, the design and distribution of questionnaire, retrieval, collation and tabulation of responses of respondents in a frequency tables for analysis. The primary data for this study were obtained through a standardized four point Likert-styled questionnaire while the secondary data were from literature, observations and personal communication with the participants

2.4.1 Questionnaire Design:

Questionnaire was used as research instrument for assessment of safety performance in Upstream, Downstream and Servicing Sectors of the Nigeria oil and gas industry.

The questionnaire had two (2) sections; sections A and B. Section A was used to gather demographic information on the respondents. Section B had three (3) subsections. Subsection I was used to collect information on organizations accident prevention module, subsection II was used to assess the level of implementation of Safety Management System (SMS) and Safety culture while subsection III was used to evaluate the Safety performance and Safety Awareness.

2.4.2 Validation of Questionnaire:

The research instrument was subjected to face and content validation by experts from the Institute of Safety Professionals of Nigeria (ISPoN). This was necessitated by the need for the items on the instrument to appear valid and logically linked to the study objectives, while also covering the full range of the issues concerning HSE management.

2.4.3 Inclusion Criteria

The criterion includes staff of the selected companies who were 18 years and above and present at work during the period of the filed sampling exercise for the study.

2.4.4 Exclusion criteria:

The criteria excluded contractors on company's facility and workers on leave at the time of field data collection (questionnaire distribution).

2.5 Data Analysis:

The survey materials were collected, sorted and the questions tabulated against the responses from the respondents. The data obtained from the questionnaires were subjected to the following analyses; descriptive statistical tools (bar charts and pie charts), ANOVA and Kendall W coefficient.

Kendall's coefficient of concordance (W) was used to test the degree of agreement between respondents on various objects on the questionnaire.

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Kendall's coefficient is a non-parametric statistical tool used to assess agreement among raters. Its values range from Zero (no agreement) to unity (complete agreement). Intermediate values signify low or high degrees of unanimity between raters (Nwaogazie, 2011).

The formula for calculating W is given by equation 2.2

$$W = \frac{12\Sigma(R_i - \bar{R})^2}{m^2 n(n^2-1)} \qquad 2.2$$

R_i represents the total rank by respondents as given by:

$$R_i = \sum_j^m = 1 r_{i,j} \qquad 2.3$$

i is an object given a rank/rating $r_{i,j}$ by respondent j

m represents the number of respondents while n represents the total number of objects (questions on the questionnaire)

$\bar{R}$ is the mean value of the total ranks as given by Equation 3.3

$$\bar{R} = \frac{1}{2} m(n+1) \qquad 2.4$$

3. RESULT AND DISCUSSION

3.1 Results:

3.1.1 Demographic distribution of respondents:

Shown in Table one is the socio-demographic distribution of respondents. The socio-demographic survey showed that more male respondents (74%) were sampled than female (26%). Also, indicated in the table is the age distribution of the respondents, distribution of respondents according to the sectors in the oil and gas industry and staff category of respondents.

Table 1: Socio-demographic distribution of respondents

Variable	No of Respondents	Percent (%)
Gender		
Male	473	74
Female	167	26
Age Distribution		
25 Yrs. & below	37	6
26 - 35 Yrs.	210	33
36 - 45 Yrs.	284	44
46 Yrs. & above	109	17
Sector of Oil Industry		
Upstream	208	32
Downstream	166	26
Servicing	266	42
Staff Category		
Full staff	324	51
Contract staff	282	44
contractor	34	5

3.1.2 Safety Management System (SMS):

It was observed that mean responses of respondents varied slightly; 3.42, 3.26 and 3.35 for upstream, downstream and servicing sector respectively. To assess if this slight difference in the mean response is statistically significant the data was subjected to ANOVA single factor test.

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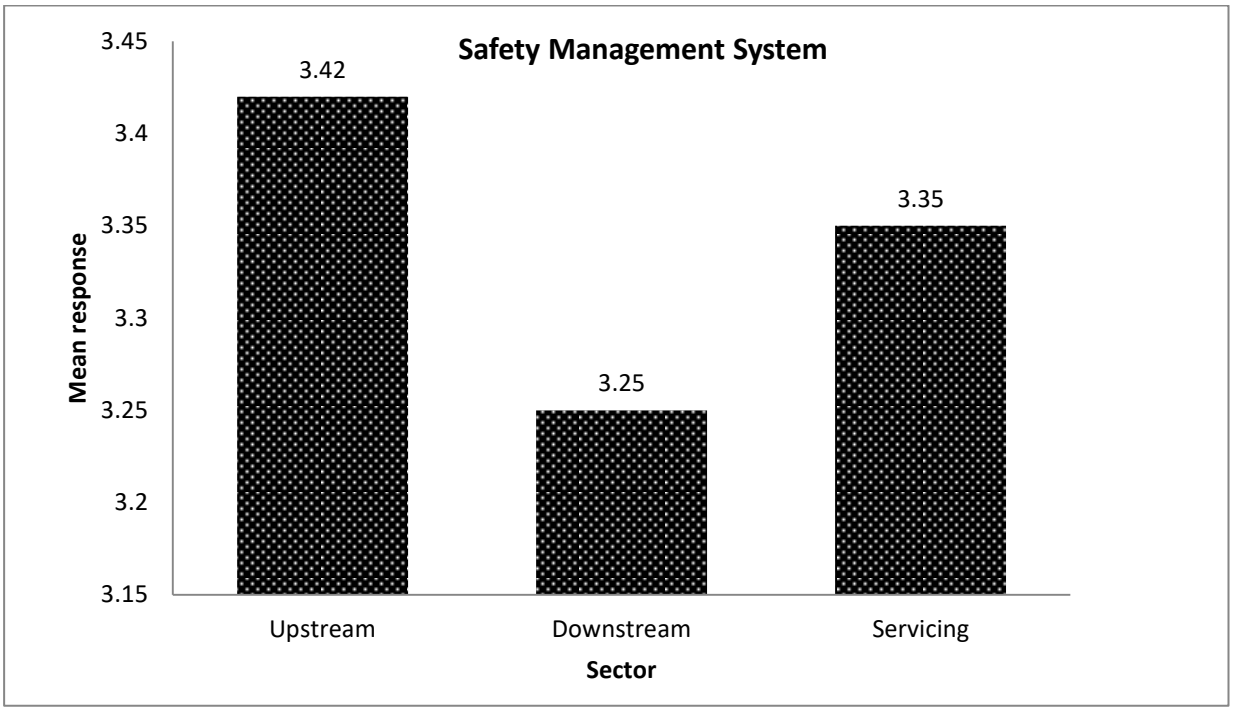

Figure 2: Mean response of respondents from the sectors in the oil and gas industry

Table two showed the result of the test. A *p*-value of <0.001 which is less than the alpha value (0.05), and therefore we conclude that there is a statistical significant difference in Safety Management System of the selected companies. However, the upstream company appeared to have a better Safety Management System.

Table 2: ANOVA result on Safety Management System

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
servicing	266	890.8909	3.349214	0.172567		
downstream	166	541.0909	3.259584	0.194567		
upstream	208	712.1636	3.423864	0.171855		
ANOVA						
Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2.49201	2	1.246005	6.998695	0.000985	3.009865
Within Groups	113.4076	637	0.178034			
Total	115.8996	639				

3.1.3 Safety Awareness:

Figure three showed the mean response of respondents from the sectors of the oil and gas industry, staff category and the various age groups to questions on safety awareness. It was observed that there was high level of safety awareness among the different groups. However, there were slight variations in the various mean.

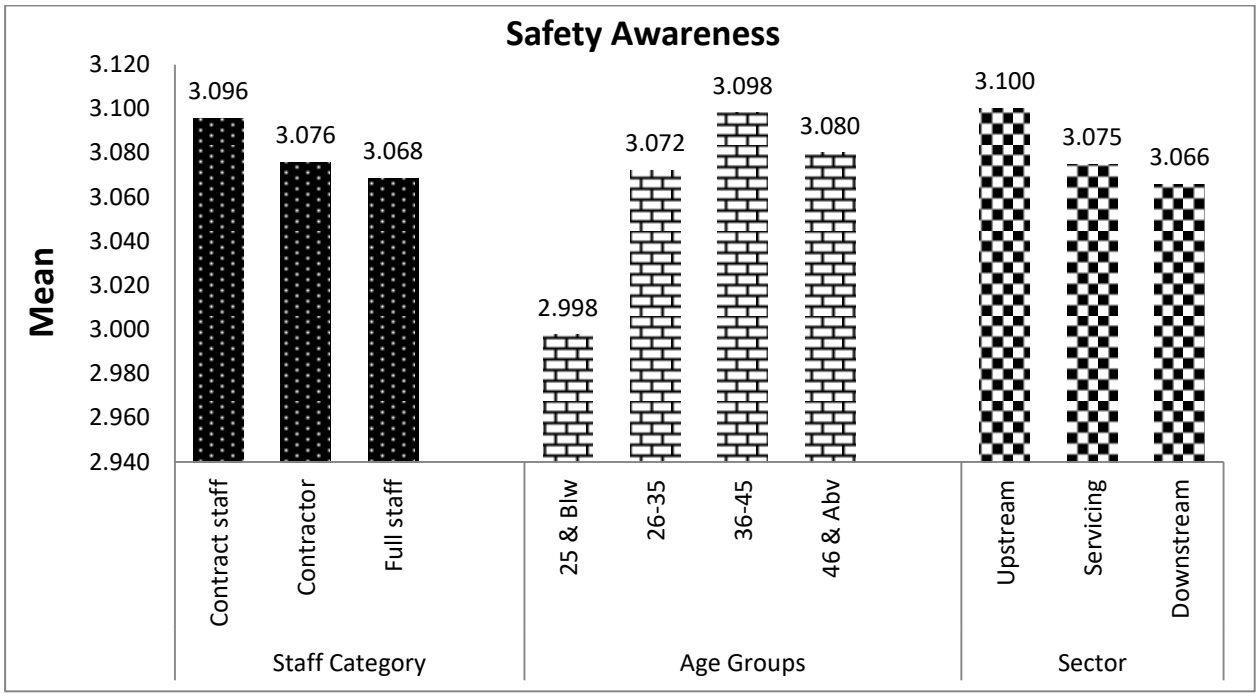

Figure 3: Safety awareness among different groups of respondents

To assess if these slight variations were statistically significant, the means of the various groups were subjected to ANOVA single factor tests. The result as shown in in Tables 3, 4 and 5 gave a *p*-value of 0.0018 for the sectors in the oil and gas industry, 0.1463 for age groups and 0.4318 for staff category.

Table 3: ANOVA result on Safety Awareness

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
servicing	266	863.5	3.246241	0.287669		
downstream	166	515.6667	3.106426	0.497022		
upstream	208	635	3.052885	0.375612		
ANOVA						
Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	4.735426	2	2.367713	6.391017	0.001786	3.009865
Within Groups	235.9927	637	0.370475			
Total	240.7281	639				

Table 4: ANOVA result on Safety Awareness

Anova: Single Factor						
SUMMARY						

Groups	*Count*	*Sum*	*Average*	*Variance*		
25 & BLW	37	110.9091	2.997543	0.057564		
26-35	210	645.1544	3.072164	0.076827		
36-45	284	879.8854	3.098188	0.057365		
46 & ABV	109	335.7273	3.080067	0.072842		
ANOVA						
Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.35806	3	0.119353	1.797492	0.146375	2.618911
Within Groups	42.23036	636	0.0664			
Total	42.58842	639				

Table 5: ANOVA result on Safety Awareness

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
CON STAFF	282	872.94413	3.0955466	0.0587503		
CONTRACTOR	34	104.57576	3.0757576	0.0656844		
STAFF	324	994.15625	3.0683835	0.0736837		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.1121375	2	0.0560687	0.8408407	0.4318259	3.0098651
Within Groups	42.476278	637	0.0666818			
Total	42.588415	639				

The *p*-value obtained for the sectors in the oil and gas industry was less than the alpha value of 0.5 suggesting that the variation in the mean of the three sectors is statistically significant. However, the values obtained for the age group and staff category were greater than the alpha valve of 0.5 implying no statistically difference in the level of awareness of the groups.

3.1.4 Management Commitment:

The response indicated that management commitment was 96%, n=199, 81%, n=215, and 70%, n=112 in the upstream, downstream and servicing sectors respectively. Safety culture, was 81%, n=82, 65%, n=66 and 70%, n=71 for upstream, downstream and servicing sectors respectively. Work procedure was 86%, n=87, 72%, n=73 and 81%, n=82 for upstream, downstream and servicing sectors respectively. Documentation and review of safety statistics responses indicated 53%, n=111, 26%, n=42, and 36%, n=96 for upstream, downstream and servicing sectors respectively.

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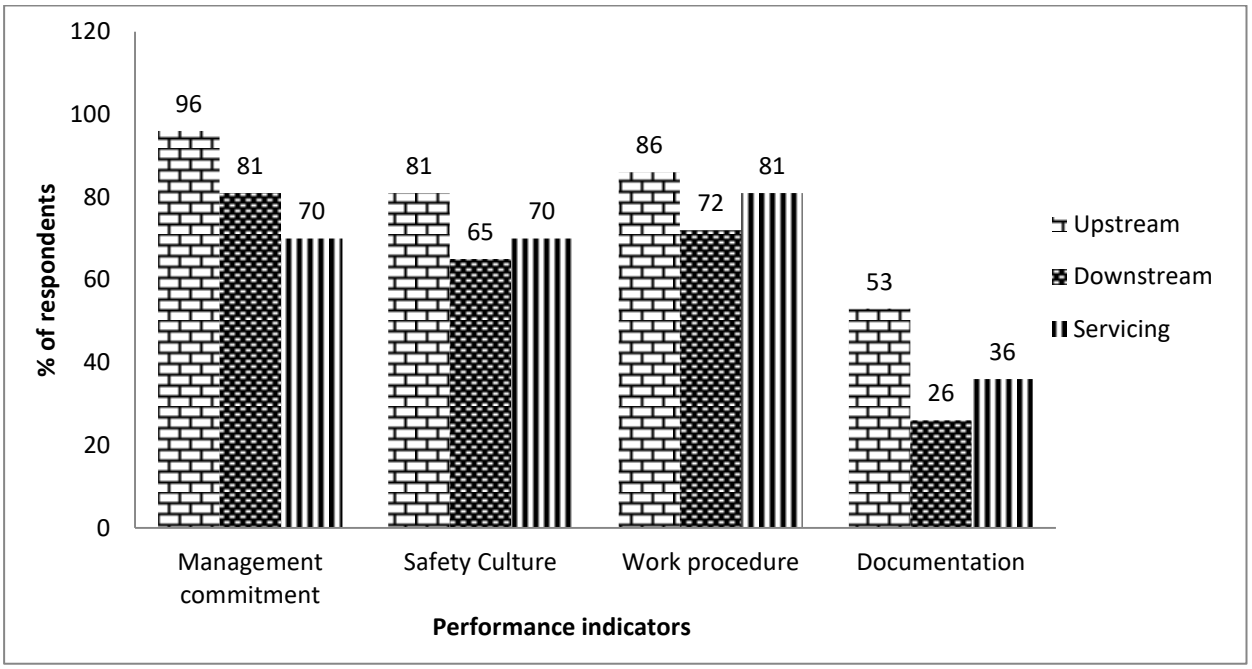

Figure 4: Safety performance indicators in the sectors of the oil and gas industry

Shown in Table six was the degree of agreement amongst respondents from the different sectors in the oil and gas industry on questions in the research instrument.

Table six showed the summary of Kendell (w) statistics for the sectors of the oil and gas industry on the questions in the research instrument.

Table 6: Degree of concordance (Kendall W) among respondents from the different sectors in the oil and gas industry

Respondents	Value of Kendall W	Percentage of concordance
Upstream	0.735	74%
Downstream	0.767	77%
Servicin	0.70	70

Kendall's W statistics for level of agreement among respondents from the upstream sector

$$\bar{R} = \frac{1}{2} * 208\,(33+1) = 3536$$

$$W = \frac{12\sum 95190955}{208^2 * 33(33^2-1)} = 0.735 \sim 74\%$$

Kendall's W statistics for level of agreement among respondents from the downstream sector

$$\bar{R} = \frac{1}{2} * 166\,(33+1) = 2839$$

$$W = \frac{12\sum 63312623}{166^2 * 33(33^2-1)} = 0.767 \sim 77\%$$

Kendall's W statistics for level of agreement among respondents from the servicing sector

$$\bar{R} = \frac{1}{2} * 266\,(33+1) = 4522$$

$$w = \frac{12\sum 148656798}{266^2 * 33(33^2-1)} = 0.702 \sim 70\%$$

3.2 Discussion:

The findings of research showed that the level of Safety awareness amongst the workers in the upstream, downstream and servicing sectors which make up the oil and gas industry in Nigeria, was high. The study revealed that the Awareness in the upstream sector appear to be higher than that of the other two sectors which further shows that upstream sectors are the drivers of Safety consciousness in Nigeria. This was evident in their commitment to ensuring safety of workers and safe working environment as ninety six percent (96%) of respondents from the upstream sector agreed that there is high management commitment to safety issues whereas eighty one (81%) percent and seventy (70%) percent of respondents from the servicing and downstream sectors agreed that there management is committed to ensuring safe work environment. This result obtained is similar to the result obtained from a similar study carried in the petroleum industry in Lagos state by Enumah (2013).

High levels of safety culture were observed in the sectors in the oil industry. The upstream sector appears to have the highest rating followed by the servicing sector and then downstream sector. The high rating of the upstream sector was attributed to the dominance of the sector by international oil companies (IOC) who ensured that her operations and activities were carried out in line with international best practices. The study further showed that there was high level adherence to work procedures in the three sectors. The high level of adherence to work procedure observed in the servicing sector which are predominantly indigenous companies could be attributed to contractual agreement with the international oil companies as they are service providers to the international oil companies (IOCs).

The results of the analysis on Documentation of Safety reports, procedure, statistics and reviews showed the reporting, reviewing and monitoring of Safety statistic records were of importance to the upstream companies hence they are adequately documented with the help of competent document controllers and because of International Standards Organization (ISO) like ISO 9000 and OHSAS 18001 requirements. The servicing companies were good in documenting Safety reports and procedures because they are service providers to the upstream sector. Most downstream companies do not regard Safety as very important, hence dedicate little time and fund to Safety documentations. The result of the Kendall's W statistics revealed that there were high degree of agreement amongst respondents from each of the different three sectors on their responses to questions on the research question.

4. CONCLUSION AND RECOMMENDATION

4.1 Conclusion:

Based on the results obtained from the analysis of data, this research therefore concluded that workers in the three sectors of oil and gas industries have various levels of safety consciousness; although the level of awareness differ. However, Safety should be given top priority in all the three sectors (Upstream, Downstream and Servicing) of Oil and Gas companies in Nigeria, to avoid, fatalities, lost time injuries, litigations and damage to company's assets.

4.2 Recommendation:

It is recommended that in as much as upstream companies recognize Safety as being as important as production and believe in continual improvement on their Safety performance, downstream and servicing companies have to be encouraged to do same by investing more into Safety in order to prevent workplace accidents.

REFERENCES

[1] Adewale Ajayi, Olufemi Babin and Marie-Thersa Phido (2014). Nigeria Oil and Gas Sector Brief. KPMG Nigeria.

[2] Alberta B., (2006). Building an effective health and safety management.http://employment.alberta.ca/documents/WHS/WHS-PS-building

[3] Antio Bhardwaj (2013). Challenges and Solutions inUpstream and Downstream oil and gas operation. www.http://globalenergy.pr.co/65678-challenges-and-solutions-in-an-upstream-and-downstream-oil-and-gas-operation

[4] Enumah J.U, Aghaji M.N. (2008). Assessment of Occupational Health Services in a Petroleum Industry in Lagos, Nigeria. Nigerian Medical Journal. 49(1)

[5] Monday Ohi Asikhia and G.C. Emenike (2013): Occupational Health and Safety in the Oil and Gas Industry in Nigeria. Jorind. 11(2) 1596-8303

[6] Nwaogazie Ify L. Probability and statistics for science and engineering practice, University of Port Harcourt Press (2nd Edition, 2006). De-Adriot Publishers, Enugu. Nigeria 3rd Edition; 2011.

[7] Nwaogazie IL, Omuruka TC, Adaramola SS (2016). Work-related musculoskeletal disorders: A case of office-based civil servants in Rivers State, Nigeria. International Journal of Tropical Disease & health.;18(1):1-13.

[8] Obasi N. K. (2003). Foreign participation in the Nigerian oil and gas industry. http://www.onlinenigeria.com/link/adv.asp?

[9] Occupational health and safety management systems. Guidelines for the implementation of OHSAS 18001:2008

[10] Okojie O. (2010): Systems for Reporting Occupational Diseases in Nigeria, Africa Newsletter on Occupational Health and Safety. 20 (3): 51-53.

[11] Omenikolo, I.A. and Amadi R.O. (2010). Challenges facing Nigerian local content in the oil and gas industry. Continental journal of renewable energy. 1: 15 – 20

[12] Onyejeji N., (2011): Nigeria Public Policy. Global Policy Brief, No 18, January 2011. Www.bc.edu/agingandwork

[13] Waqas Ahmed Khan, Talha Mustaq and Anmol Tabassum (2014). Occupational Health, Safety and Risk Analysis. International Journal of Science, Environment and Technology. 3 (4): 1336 – 1346