

# Impact Of Safety Climate On Safety Performance Of Firms In Onne Oil And Gas Free Zone; A Comparative Study Of Good And Bad Safety Performing Companies In The Study Area

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## ABSTRACT

This study examined the impact of Safety Climate on Safety Performance of companies in Onne oil and gas free zone, River's state; a comparison of good and bad safety performing firms. The study adopted descriptive and regression research design. The companies were categories into two groups based on the safety performance chart as "good and bad safety performing companies", 20 companies were sampled randomly from 170 companies with 6400 workers population, and 400 were sampled and shared 200 per group. A questionnaire titles "Safety Climate, Behaviour and Performance Questionnaire (SCBPQs, design based on Likert 5-point scale, was used for data collection and analysis was done using descriptive and inferential statistics. The results of descriptive analysis showed that the safety climate level for both group is encouraging; (4.66 and 3.78) > (3), and that good safety climate resulted to improved safety performance for both good and bad safety performing firms (4.69, 3.80; 4.63, 3.74) > (3). The results of hypothesis testing revealed that safety climate significantly impact on safety performance for good-performing firms (p-values 0.026; 0.035) < 0.05 significant value while for bad-performing firm, safety climate also significantly impact safety performance (p-value 0.048) < 0.05 significant level. It was concluded that safety climate level is encouraging for both the good and bad safety performing firms and as such improved safety performance of companies. It was recommended that more improvement in required especially from bad-performing firms therefore safety management authorities should help by organizing workshop on safety to further improve the safety performance of the firms

**Key words;** Safety Climate, Safety performance, Good and Bad Safety performing firms, Onne oil and gas free zone (OGFZ)

## 1.1 Introduction

Globally, workplace injuries and illnesses result in about 5% loss of global Gross Domestic Product (GDP) (WHO, 2008) and according to "Bureau of Economic Analysis" in their report

presented in 2018, these losses are expected to cost the global economy an estimated \$5 trillion a year, in addition to human suffering and loss of life. In USA, fatal work injury occurs every 115 minutes (i.e., less than 2 hours) and a disabling injury occur every 10 seconds (Bureau of Labour Statistics, 2010). Massive and large-scale accidents such as the “Chernobyl nuclear plant in Russia, Deep-water Horizon, and BP Texas City refinery in the United States, West-ray coal mine in Canada, Piper Alpha oil platform in Great Britain, Bhopal Union Carbide gas plant in India, or Waterfall Rail accident in Australia” have all revealed and provided undoubtable and dramatic evidence of the human, economic, and environmental costs of workplace and industrial accidents (Chiles, 2001). However, despite these economic and social significance of safety issues, they have received only very minimal attention by science and engineering scholars (Glendon et al, 2006)

In Nigeria, though there is no published statistical report on the quantification of the economical and health impact of workplace related injuries and fatalities, however, the International Labour Organization (ILO) (2006) estimated that over 2.2 million people die every year from workplace related accidents and diseases, while some 270 million suffer serious non-fatal injuries, another 160 million fall ill for short or long period from work-related causes, emanating from problems and challenges associated with unsafe working environment or condition. This represents an enormous toll of suffering for workers and their families. Also study by the European Commission estimates that the costs of workplace related accidents in the EU15 (15 European Union Member States) in the year 2000 was €55 billion a year (ILO, 2006).

Workplace safety is determined by various intervening broad concepts, including safety performance and safety climate, on which this study is based. Thus, safety climate is the concept that concerns with the description of the collective perception of workers as regards to the safety value, safety practices and safety seriousness of their organization or firm. Safety climate is among the safety concepts that receive global attention across industry because a good level of safety climate is important in achieving safety at work place (Ausserhofer, *et al.* (2013). Fray *et al.*, (2015) noted that safety climate describes attitudes to safety within an organization, and differs from other safety concepts such as safety culture, which denotes a strong conviction or dogma that underlies safety attitudes. However, despite the lack of consistent distinctions between organizational culture and organizational climate in the literature, there is evidence of concordance that safety climate and safety culture are related but different terms (Hofmann et al, 2013)

According to Nevhage and Lindahl (2008) safety performance is defined as the quality of safety related work. And its improvement in an organization can increase robustness and lower risk of accidents and incidents. Sawacha, et al (1999) stated that safety performance can be effect by; lack of controlled working environment, complexity and organizations size. Good safety performance and high productivity are companions and related (Memarian, 2017). Practice of good safety performance is important element to improve effective management of safety in any organization, thus, in this study safety performance can be measures by frequencies of accident and incident occurrence, such that increase in frequency of accident and incident occurrence signifies poor safety performance while reduced cases of accident and incident occurrence implies good safety performance. Thus, good safety climate is expected to trigger good safety performance while bad safety climate is expected to cause poor safety performance.

The Onne Oil and Gas Free Zone (OGFZ) is an area in Eleme local government area of River state, Nigeria which was map-out by Nigeria government as free access zone for

conglomerate of companies that directly or indirectly deals in oil and gas related businesses. This area is made up of over 170 different oil and gas related firm that operates and function on daily basis and the operation and activities of the workers in these firms are extremely risky and unsafe which is evidence by several cases of accident leading to injuries and fatalities in this area. This situation has triggered questions as regards to the safety climate of the zone and how the safety climate of this zone is affecting the safety performance of the workers operating in this area. Thus, it is this narrative that necessitated the conduct of this current study.

## 2 Aim and Objectives

This study is basically designed to ascertain the possible impacts of safety climate on the safety performance of the firms operating in Onne oil and gas free zone (OGFZ) with special consideration to comparison of the good and bad safety performing firms and the objectives are to

1. Ascertain the condition of safety climate across selected good and bad safety performing companies in Onne Oil and gas free zone.
2. Determine the impact of safety climate and safety performance in the good and bad safety performing firm in Onne Oil and gas free zone.

## 3 Research Questions

1. What is the level of safety climate and safety performance across selected good and bad safety performing companies in Onne Oil and gas free zone.
2. What is the impact of safety climate and safety performance in the good and bad safety performing firm in Onne Oil and gas free zone.

## 4 Hypothesis Testing

1. Safety climate has no significant impact on safety performance across selected good and bad safety performing companies in Onne Oil and gas free zone

## 5 Methodology

The study adopted a combination of descriptive and regression design. The descriptive design was used to determine the perception of the workers on safety climate across the selected good and bad safety performing companies while regression was used to ascertain the impact safety climate constructs (management commitment on safety, safety communication and safety training) on the safety performance constructs (frequency of accident occurrence and frequency of incident occurrence). Employees of organizations in this study area formed the population of the study. There are 170 companies within the Onne OGFZ with 6400 employees. Thus, the population of this study were 6400 workers in the companies' operating within the Onne Oil and Gas Free Zone irrespective of level of education and job specialty. Purposive Sampling Technique was used to select twenty (20) companies, ten (10) good and ten (10) poor safety performing companies, Table 1 and 2 show the performance indicator for good and bad safety performing firms respectively and their workers were sampled for the safety climate questionnaire survey. These companies were identified and selected using the Onne OGFZ Annual Health, Safety and Environment (AHSE) safety performance assessment reports for 2016-2018. Sample size was determined (or calculated) using a scientifically recognized equation. Thus, this study will use the popular Taro Yamane mathematical equation illustrated as:

$$n = \frac{N}{(1 + N)(\epsilon)^2} \quad (1)$$

Where, n = Sample size, N = Population under study,  $\epsilon$  = Margin error (which could be 0.10, 0.05 or 0.01 for 90%, 95% or 99% level of significance respectively).

Thus, for an estimated total population of 6,400 employees, the sample size for this study, assessed at a margin error of 0.05 level of significance, can be calculated using equation (1) as shown below:

$$n = \frac{N}{(1 + N)(\epsilon)^2} = \frac{6400}{(1 + 6000)(0.05)^2} = \frac{6400}{(1 + 6000)(0.0025)}$$

$$n = \frac{6000}{(1 + 15)} = \frac{6000}{(16)} = 400$$

From the result above, a total of 400 employees forms the basic sample size for this study, therefore 200 employees were selected from each of the both the good and bad safety performing companies sampled.

**Table 1 Distribution of Companies based on HSE Performance Scores from Total Recordable and Undesirable Incidents (2016 – 2018)**

S/N	Company name	Performance Indicators Score (Number of accident and incidents)			Average Score
		2016	2017	2018	
<b>A. Good Safety Performing Companies</b>					
1	Company A1	0	0	0	<b>0</b>
2	Company A2	0	0	0	<b>0</b>
3	Company A3	0	0	0	<b>0</b>
4	Company A4	0	0	0	<b>0</b>
5	Company A5	0	0	0	<b>0</b>
6	Company A6	0	0	0	<b>0</b>
7	Company A7	0	0	0	<b>0</b>
8	Company A8	0	0	0	<b>0</b>
9	Company A9	0	0	0	<b>0</b>
10	Company A10	0	0	0	<b>0</b>

**Source: Computed from OGFZA HSE Consultative Committee Report, 2018. Note: Alphanumeric pseudonyms were used for company names as the OGFZA HSE report 2018 is yet to be in public domain.**

**Table 2 Distribution of Companies based on HSE Performance Scores from Total Recordable and Undesirable Incidents (2016 – 2018)**

S/N	Company name	Performance Indicators Score (Number of accident and incidents)			Average Score
		2016	2017	2018	
<b>A. Bad Safety Performing Companies</b>					
1	Company B1	47	54	33	<b>45</b>
2	Company B2	45	33	33	<b>37</b>
3	Company B3	41	30	30	<b>34</b>
4	Company B4	33	31	32	<b>32</b>
5	Company B5	31	19	19	<b>23</b>
6	Company B6	19	17	27	<b>21</b>
7	Company B7	41	30	30	<b>34</b>
8	Company B8	45	40	41	<b>42</b>
9	Company B9	38	37	32	<b>36</b>
10	Company B10	36	34	38	<b>36</b>

**Source: Computed from OGFZA HSE Consultative Committee Report, 2018. Note: Alphanumeric pseudonyms were used for company names as the OGFZA HSE report 2018 is yet to be in public domain.**

The study used primary data which was collected through administration of survey questionnaires, during a field survey. This study focuses on safety management commitment, safety training and safety communication as safety climate variables, whereas frequency of accident and frequency of incident occurrence were used as variable for safety performance. Thus, these important safety variables were used to construct the Safety Climate and safety Performance Questionnaires (SCSPQs) for the field survey. The SCSPQs comprises of items to be rated on a 5-point Likert scale. The face and content validities were ascertained by researcher supervisor being experts in Occupational health and safety studies. There searcher’s supervisors were required to vet items in these instruments, to look at clarity of words, sentences and whether variables of this study were properly captured

The self-administered SCSPQ was pre-tested among workers in another two poor and good safety performing companies who were not selected for the study. The pre-test was carried out with a sample size of 10% of the original sample size which is 10% of 400 which is 40 participants were used and their reliability was tested using Cronbach’s alpha reliability test. A Cronbach’s alpha coefficient of a scale above 0.70 is considered to “suitable” for the research (Nunnally &

Bernstein, 1994). See table 2. Four hundred (400) questionnaires were administered and 352 were properly filled and used in the analysis

**Table 3 Summary of Cronbach's Alpha Reliability Result**

Variables	Dimensions/Measures	No. of items	Alpha Coefficients
Safety Climate	Safety Management Commitment	4	0.790
	Safety Communication	3	0.796
	Safety Training	4	0.725
Safety performance	Incident Occurrence	7	0.872
	Accident Occurrence	8	0.884

Source: Researcher's computation 2021

**Table 4: Summary of Response rate**

	Good Performing Companies	Bad Performing companies
Questionnaire Administered	200	200
Returned questionnaire	195	189
Properly completed, returned and used questionnaire	188	176
Percentage of properly completed, returned and used questionnaire	94.0%	88.0%

Source: Researcher's Computation, 2021

Finally, the study employed standard statistical tools and methods to analyse data collected, the descriptive statistics which include means, percentages, weight average and ordinal regression were used for analysis. The descriptive statistic was used to answer research questions and while regression analysis was used to test hypothesis on relationship between variables which are safety climate and safety performance The Statistical Package for Social Sciences (SPSS) application tool was used to carry out the analyses. Results of findings were presented on tables and charts.

## 6 Results

### 1, What is the level of safety climate and safety performance condition across the selected good and bad safety performing companies within Onne Oil and Gas Free Zone (OGFZ)?

The descriptive analysis was conducted to ascertain the condition of safety climate in the good and bad safety performing firms in this studies area, the descriptive variable assessed were

mean, percentage and weight average which helped to answer the research question 1. Table 5 and Table 6 reveals the safety climate construct for the three safety climate variables used in this study which includes safety management commitment, safety communication and safety training. Construct 1 to 4 in these tables captured safety management commitment, construct 5 to 7 captured safety communication, while 8 to 11 captured safety training

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**Table 5 Level of Safety Climate for Good Performing Companies**

SN	Items	SA	A	D.	SD	UN	WA	R
1	My workplace is safe	135.0 71.80%	53.00 28.20	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.72	Agree
2	Management has made necessary provisions to ensure safety at my workplace	68.00 36.17%	91.00 48.40%	29.00 15.43%	0.00 0.00%	0.00 0.00%	4.21	Agree
3	Resources made available by management for health and safety are adequate	106.00 56.38%	82.00 43.62%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.56	Agree
4	There is good preparedness by management for safety emergency here	151.00 80.32%	37.00 19.68%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.80	Agree
5.	There are good communications here between management and workers about health and safety issues	149.00 79.26%	39.00 20.74%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.79	Agree
6.	My immediate boss often talks to me about health and safety matters on site	122.00 64.90%	52.00 27.65%	14.00 7.45%	0.00 0.00%	0.00 0.00%	4.57	Agree
7	The company encourages suggestions on how to improve health and safety	135.0 71.80%	53.00 28.20	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.72	Agree
8	Safety training are done regularly in my company	135.0 71.80%	53.00 28.20%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.72	Agree
9	I believe the safety training done in my company are adequate	135.00 71.80%	42.00 22.34%	11.00 5.86%	0.00 0.00%	0.00 0.00%	4.66	Agree
10	I believe the safety training done in my company are suitable for my job	149.00 79.25%	28.00 14.89%	11.00 5.86%	0.00 0.00%	0.00 0.00%	4.73	Agree
11	The knowledge I acquired from safety training in my company have help me avoid accidents and incidents	150.00 79.79%	38.00 20.21%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.80	Agree
	<b>TOAL</b>						<b>4.66</b>	

Source; Researchers Computation 2021

SA-Strongly Agreed, A-Agreed, UN-Undecided, D - Disagreed and SD - Strongly Disagreed WA- Weighted Average R- Remark



**Table 6 Level of Safety Climate for Bad Performing Companies**

SN	Items	SA	A	D	SD	UN	WA	R
1	My workplace is safe	76.00 43.13%	69.00 39.20%	26.00 14.77%	5.00 2.90%	0.00 0.00%	4.23	Agree
2	Management has made necessary provisions to ensure safety at my workplace	15.00 8.52%	43.00 24.43%	11.00 6.25%	48.00 27.27%	59.00 33.53%	2.47	Disagree
3	Resources made available by management for health and safety are adequate	28.00 15.91%	106.00 60.23%	26.00 14.77%	11.00 6.25%	5.00 2.90%	3.80	Agree
4	There is good preparedness by management for safety emergency here	44.00 25.00%	109.00 61.93%	11.00 6.25%	12.00 6.82%	0.00 0.00%	4.05	Agree
5.	There are good communications here between management and workers about health and safety issues	25.00 14.21%	106.00 60.23%	34.00 19.32%	5.00 2.90%	6.00 3.41%	3.79	Agree
6.	My immediate boss often talks to me about health and safety matters on site	28.00 15.91%	123.00 71.02%	14.00 7.95%	5.00 2.90%	8.00 4.55%	3.92	Agree
7	The company encourages suggestions on how to improve health and safety	43.00 24.43%	89.00 50.57%	25.00 14.21%	11.00 6.25%	8.00 4.55%	3.84	Agree
8	Safety training are done regularly in my company	73.00 41.48%	81.00 46.02%	16.00 9.09%	6.00 3.41%	0.00 0.00%	4.26	Agree
9	I believe the safety training done in my company are adequate	37.00 21.02%	118.00 67.05%	4.00 2.27%	6.00 3.41%	11.00 6.25%	3.93	Agree
10	I believe the safety training done in my company are suitable for my job	33.00 18.75%	116.00 65.91%	10.00 5.68%	12.00 6.82%	5.00 2.90%	3.91	Agree
11	The knowledge I acquired from safety training in my company have help me avoid accidents and incidents	23.00 13.07%	60.00 34.09%	66.00 37.50%	19.00 10.80%	8.00 4.55%	3.40	Agree
	<b>TOAL</b>						<b>3.78</b>	

Source; Researchers Computation 2021

SA-Strongly Agreed, A-Agreed, UN-Undecided, D - Disagreed and SD - Strongly Disagreed WA- Weighted Average R- Remark

Based on these scale and considering the average value of the construct in Table 5 and Table 6 above for good and bad safety performing firms, it was revealed that weighed average value for the first four constructs (1-4) that captured safety management commitments were 4.72, 4.21, 4.56, 4.80 for the good safety performing firms and 4.23, 2.47, 3.80 and 4.05 for bad safety performing firms, these results revealed that the management's commitment on safety issues are highly encouraging for good performing firms but for bad performing firms, they are highly encouraging for first and fourth construct but not encouraging for the third and fairly encouraging for the third construct. This means that workers in all the good safety performing firms strongly agree that the management commitment on their safety concerns are considerable high and encouraging in all ramification, but for the bad performing firms, the workers agree that management commitment on their safety concerns are encouraging when it comes to providing necessary resources to ensure safety of their workers. Thus, this observation within safety management commitment construct, particularly for second construct, could be reason that triggered poor safety behaviour and poor safety performance.

For the second safety climate variable (safety communication) which was captured by three constructs 5 to 7, it was observed that the mean values for the three constructs are 4.79, 4.57 and 4.72 for the good performing firms and 3.79, 3.92 and 3.84 for the bad performing firms. This results, based on the scale, revealed that the workers in the good performing strongly agree that the safety communication between them and their superiors are at appreciably very high acceptable level. For the bad performing firms, the results revealed that the workers agree that their safety communication with their superiors are at good acceptable level

For the third and last safety climate variable (safety training) which was captured by four constructs 8 to 11, it was observed that the mean values for the four constructs are 4.72, 4.66, 4.73 and 4.80 for the good safety performing firms and for the bad safety performing firms the means value for these constructs are 4.26, 3.93, 3.91 and 3.40. This results, based on the scale, revealed that the workers in the good performing strongly agree that the safety training concerns of the workers are handled very well which suggest a very high acceptable level of for the entire safety climate variable; combining the three safety climate variables considered based on the eleven constructs; for the good and bad performing firms are 4.66 and 3.76 respectively which, based on the scale, means that safety climate level at the good and bad safety performing firms are at very high level and high level respectively and both are significant. Thus, having confirmed that the safety climate levels at these companies are high, we can then investigate how they affect the safety performance of the firms

**Table 7. Frequency of Incident Occurrence for Good Performing Companies**

SN	Items	SA	A	D	SD	UN	WA	R
1	Sufficient safety resources are made available by management and that has reduced occurrence of incident in my workplace	137.00 72.88%	51.00 27.12%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.73	Agree
2	Management has made necessary provisions for safety at my workplace and that has reduced Frequency of Incident Occurrence	137.00 72.88%	39.00 20.75%	12.00 6.38%	0.00 0.00%	0.00 0.00%	4.66	Agree
3	The good safety communication between management and workers has reduced Frequency of Incident Occurrence	148.00 78.74%	40.00 22.26%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.79	Agree
4	My company encourages suggestions on how to improve safety and health and that has reduced occurrence of incident in my workplace	123.00 65.44%	65.00 34.56%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.65	Agree
5.	My immediate boss often talks to me about health and safety matters on site and that has minimized chances of incident occurrence.	81.00 43.09%	107.00 56.91%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.43	Agree
6.	My company gives safety training and that has minimized chances of incident occurrence.	123.00 65.44%	65.00 34.56%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.65	Agree
7	I consider safety training given by my company adequate and I feel that has minimized chances of incident occurrence.	157.00 83.52%	31.00 16.48%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.80	Agree
8	The company gives regular and up-to-date safety training and that has minimized chances of incident occurrence.	163.00 86.72%	14.00 7.45%	11.00 5.83%	0.00 0.00%	0.00 0.00%	4.81	Agree
<b>TOAL</b>							<b>4.69</b>	

Source; Researchers Computation 2021

SA-Strongly Agreed, A-Agreed, UN-Undecided, D - Disagreed and SD - Strongly Disagreed WA- Weighted Average R- Remark

**Table 8 Frequency of Incident Occurrence for Bad Performing Companies**

SN	Items	SA	A	D	SD	UN	WA	R
1	Sufficient safety resources are made available by management and that has reduced occurrence of incident in my workplace	39.00 22.16%	115.00 65.34%	5.00 2.84%	17.00 9.66%	0.00 0.00%	4.00	Agree
2	Management has made necessary provisions for safety at my workplace and that has reduced Frequency of Incident Occurrence	36.00 20.46%	103.00 58.52%	36.00 20.46%	5.00 2.84%	6.00 3.41%	3.78	Agree
3	The good safety communication between management and workers has reduced Frequency of Incident Occurrence	32.00 18.18%	80.00 78.41%	58.00 32.96%	6.00 3.41%	0.00 0.00%	3.78	Agree
4	My company encourages suggestions on how to improve safety and health and that has reduced occurrence of incident in my workplace	5.00 2.84%	104.00 59.09%	61.00 34.66%	6.00 3.41%	0.00 0.00%	3.61	Agree
5.	My immediate boss often talks to me about health and safety matters on site and that has minimized chances of incident occurrence.	33.00 18.75%	86.00 48.87%	52.00 29.55%	5.00 2.84%	0.00 0.00%	3.84	Agree
6.	My company gives safety training and that has minimized chances of incident occurrence.	30.00 17.05	100.00 56.82%	41.00 23.30%	5.00 2.84%	0.00 0.00%	3.88	Agree
7	I consider safety training given by my company adequate and I feel that has minimized chances of incident occurrence.	38.00 21.59%	90.00 51.14%	37.00 21.02%	11.00 6.25%	0.00 0.00%	3.88	Agree
8	The company gives regular and up-to-date safety training and that has minimized chances of incident occurrence.	8.00 6.81%	102.00 57.96%	50.00 28.41%	6.00 3.41%	6.00 3.41%	3.64	Agree
<b>TOAL</b>							<b>3.80</b>	

Source; Researchers Computation 2021

SA-Strongly Agreed, A-Agreed, UN-Undecided, D - Disagreed and SD - Strongly Disagreed WA- Weighted Average R- Remark

Based on this scale and considering the weight average value of the construct in Table 7 and Table 8 above for good and bad safety performing firms, it was revealed that weighed average value for the first two constructs (1 and 2) that captured relationship between management commitments to safety and occurrence of incident were 4.73 and 4.66 for the good safety performing firms and 4.00 and 3.78 for bad safety performing firms. These results revealed that the respondent agree that management's commitment on safety issues negatively affected incident occurrence in their companies which means that increase in commitment of the management on safety of the workers would result to reduction in occurrence of incidents in the companies for both the good and bad performing firms respectively since the weight average for all the construct is above 3. However, the response of the respondents revealed that the effects higher in good performing firm compare to the bad performing,

The next three constructs (3-5) captured response of the respondents on the relationship between communication and interaction of the management staffs with their workers on safety related issues and occurrence of incidents and the weight averages are the response are 4.65, 4.80, 4.81 for the good performing companies and 3.78, 3.61, 3.84. These results revealed that respondents agree that the level of interaction and communication between management staffs and their worker negatively affects occurrence of incident in the companies which means that workers in both good and bad safety performing firms agree that increasing the level of interaction and communication of the management and workers on safety related issues helped to reduce occurrence of incidents in the companies since the weight average for all the three construct is above 3, however, the response of the respondents revealed that the effects is higher in good performing firm compare the bad performing,

The last three construct (6-8) captured response of the relationship between safety related training offered by the companies and occurrence of incident in the company for good and bad safety performing firms. The weight averages of the response are 4.58, 4.74, 4.73, for the good performing companies and 3.88, 3.88, 3.64. These results revealed that the respondents agree that the safety training offered by both the good and bad safety performing companies negatively affected occurrence of incident in the companies which means that increase in safety related trainings would reduce occurrence of incidents in the companies, this is because the weight average for all the three construct is above 3, however, the response of the respondents revealed that the effects is more in good performing firm compare the bad performing

Finally, the overall relationship between safety climate and incident occurrence which is captured by overall weight average for the good and bad safety is given as 4.69 and 3.80. These results means that the respondents agree that the relationship between overall safety climate and the incidents occurrence in the companies is negative which means that the safety climate of the companies is encouraging and that has reduced occurrence of incident in the companies. However, the response of the respondents is higher in good safety performing firms compare to bad safety performing firms.

**Table 9 Frequency of Accident Occurrence for Good Performing Companies**

SN	Items	SA	A	D	SD	UN	WA	R
1	Sufficient safety resources are made available by management and that has reduced accident or injury at my workplace?	151.00 80.33%	26.00 13.83%	11.00 5.85%	0.00 0.00%	0.00 0.00%	4.74	Agree
2	Management has made necessary provisions for safety at my workplace and that has reduced experiences of accidents or injury in my workplace	98.00 52.14%	92.00 47.86%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.51	Agree
3	The good safety communication between management and workers has reduced possibility of accident or injury	123.00 65.44%	65.00 34.56%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.65	Agree
4	The good safety communication between management and workers has reduced chances of accident or injury	137.00 72.88%	51.00 27.12%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.73	Agree
5.	My company encourages suggestions on how to improve safety and health and that has reduced cases of accident or injury.	123.00 65.44%	65.00 34.56%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.65	Agree
6.	I consider safety training given by my company adequate and I feel that has minimized chances of accidents occurrence.	123.00 65.44%	65.00 34.56%	0.00 0.00%	0.00 0.00%	0.00 0.00%	4.65	Agree
7	The company gives regular and up-to-date safety training and that has minimized chances of accident occurrence.	110.00 58.52%	31.00 16.49%	20.00 10.64%	27.00 14.35%	0.00 0.00%	4.47	Agree
<b>TOAL</b>							<b>4.63</b>	

Source; Researchers Computation 2021

SA-Strongly Agreed, A-Agreed, UN-Undecided, D - Disagreed and SD - Strongly Disagreed WA- Weighted Average R- Remark

**Table 10 Frequency of Accident Occurrence for Bad Performing Companies**

SN	Items	SA	A	D	SD	UN	WA	R
1	Sufficient safety resources are made available by management and that has reduced accident or injury at my workplace?	12.00 5.82%	110.00 62.48%	42.00 23.86%	13.00 7.84%	0.00 0.00%	3.69	Agree
2	Management has made necessary provisions for safety at my workplace and that has reduced experiences of accidents or injury in my workplace	10.00 5.68%	112.00 63.62%	40.00 22.72%	15.00 8.52%	0.00 0.00%	3.69	Agree
3	The good safety communication between management and workers has reduced possibility of accident or injury	31.00 17.61%	117.00 66.46%	23.00 13.06%	6.00 3.41%	0.00 0.00%	3.97	Agree
4	The good safety communication between management and workers has reduced chances of accident or injury	37.00 21.02%	108.00 61.34%	31.00 17.64%	0.00 0.00%	0.00 0.00%	3.61	Agree
5.	My company encourages suggestions on how to improve safety and health and that has reduced cases of accident or injury.	12.00 6.84%	117.00 66.46%	41.00 23.30%	6.00 3.41%	0.00 0.00%	3.77	Agree
6.	I consider safety training given by my company adequate and I feel that has minimized chances of accidents occurrence.	24.00 13.68%	105.00 59.64%	37.00 21.02%	12.00 6.84%	6.00 3.41%	3.80	Agree
7	The company gives regular and up-to-date safety training and that has minimized chances of accident occurrence.	12.00 6.84%	105.00 59.64%	37.00 21.02%	6.00 3.41%	6.00 3.41%	3.63	Agree
<b>TOAL</b>							<b>3.74</b>	

Source; Researchers Computation 2021

SA-Strongly Agreed, A-Agreed, UN-Undecided, D - Disagreed and SD - Strongly Disagreed WA- Weighted Average R- Remark

Based on this scale and considering the weight average value of the construct in Table 9 and Table 10 above for good and bad safety performing firms, it was revealed that weighed average value for the first two constructs (1 and 2) that captured relationship between management commitments to safety and occurrence of accidents were 4.74 and 4.51 for the good safety performing firms and 3.69 and 3.69 for bad safety performing firms. These results revealed that the respondent agree that management's commitment on safety issues negatively affected accidents occurrence in their companies which means that increase in commitment of the management on safety of the workers would result to reduction in occurrence of accidents in the companies for both the good and bad performing firms respectively since the weight average for all the construct is above 3. However, the response of the respondents revealed that the effects higher in good performing firm compare to the bad performing,

The next three constructs (3-5) captured response of the respondents on the relationship between communication and interaction of the management staffs with their workers on safety related issues and occurrence of accidents and the weight averages are the response are 4.65, 4.73, 4.65 for the good performing companies and 3.97, 3.61, 3.77. These results revealed that respondents agree that the level of interaction and communication between management staffs and their worker negatively affects occurrence of accidents in the companies which means that workers in both good and bad safety performing firms agree that increasing the level of interaction and communication of the management and workers on safety related issues helped to reduce occurrence of accident in the companies since the weight average for all the three construct is above 3, however, the response of the respondents revealed that the effects is higher in good performing firm compare the bad performing,

The last three construct (6-7) captured response of the relationship between safety related training offered by the companies and occurrence of incident in the company for good and bad safety performing firms. The weight averages of the response are 4.58, 4.74 for the good performing companies and 3.88, 3.64. These results revealed that the respondents agree that the safety training offered by both the good and bad safety performing companies negatively affected occurrence of accident in the companies which means that increase in safety related trainings would reduce occurrence of accident in the companies, this is because the weight average for all the three construct is above 3, however, the response of the respondents revealed that the effects is more in good performing firm compare the bad performing

Finally, the overall relationship between safety climate and accident occurrence which is captured by overall weight average for the good and bad safety is given as 4.63 and 3.74. These results means that the respondents agree that the relationship between overall safety climate and the accident occurrence in the companies is negative which means that the safety climate of the companies is encouraging and that has reduced occurrence of accidents in the companies. However, the response of the respondents is higher in good safety performing firms compare to bad safety performing firms.



**2. What is the impact of safety climate and safety performance in the good and bad safety performing firm in Onne Oil and gas free zone.**

**Table 11 The Ordinal regression statistical analysis for the significance of the relationship safety climate and frequency of incidence occurrence for the Good Safety performing companies in Onne Oil and Gas Free Zone (OGFZ)**

Variables	<b>Frequency of incident Occurrence</b>				
	N.	Degree of Freedom	Pseudo R-Square	Significant level (0.05)	Decision
Safety Management Committeemen	188	1	0.610	0.001	<b>Significant</b>
Safety communication	188	1	0.610	0.000	<b>Significant</b>
Safety Training	188	1	0.610	0.006	<b>Significant</b>
<b>Safety Climate</b>	188	1	0.610	0.026	<b>Significant</b>

(Source, SPSS Analysis of Researchers data 2021)

Table 11 revealed that the Pseudo R-square value for the Safety Climate variables captured using safety management commitment, safety communication and safety training is 0.610. This means that 61% of change in frequency of Incidence Occurrence in the good safety performing companies within this researched area is due to change in the safety climate level; captured by safety management commitment, safety communication and safety training; implying that the remaining 39% change is due to other factors or variables that were not captured in this present model.

Table 11 also revealed that the significant level for the safety climate variables; safety management commitment, safety communication and safety training; are 0.001, 0.000 and 0.006. Using 0.05 significant level, and the rule that when significant values of any independent variable is lower than the 0.05, then such variable is a significant factor that have notable impact on dependent variable while significant values of independent variable higher than 0.05 is not significant and do not have notable impact on change in dependent variable, This means that all the variables that expressed safety climate in this model namely safety management commitment, safety communication and safety training are significant variable or factors that stimulates appreciable change on reducing frequency of incident occurrence within the good safety performing firms in this researched area. On the overall, safety climate significant level is 0.026 which is lower than 0.05 significant limit, therefore, based on the rules, safety climate has significant impact on frequency of incident occurrence which means that the change in safety climate; captured by combination of safety management commitment, safety communication and safety training; has significant impact on change on frequency of incident occurrence among worker in good safety performing companies in this researched area.

Therefore, based on these results, we reject the null hypothesis which stated that “The Safety Climate does not significantly impact on frequency of Incident Occurrence in the selected good safety performing companies in Onne Oil and gas free zone” and accept the alternate hypothesis

which stated that “The Safety Climate significantly impact on frequency of Incident Occurrence in the selected good safety performing companies in Onne Oil and gas free zone”

**Table 12 The Ordinal regression statistical analysis for the significance of the relationship safety climate and frequency of incidence occurrence for the Bad Safety performing companies in Onne Oil and Gas Free Zone (OGFZ)**

Variables	Frequency of Incident Occurrence				
	N.	Degree of Freedom	Pseudo R-Square	Significant level (0.05)	Decision
Safety Management Committeemen	176	1	0.510	0.031	<b>Significant</b>
Safety communication	176	1	0.510	0.040	<b>Significant</b>
Safety Training	176	1	0.510	0.054	<b>Not Significant</b>
<b>Safety Climate</b>	176	1	0.510	0.048	<b>Significant</b>

(Source, SPSS Analysis of Researchers data 2021)

Table 12 above revealed that the Pseudo R-square value for the Safety Climate variables captured using safety management commitment, safety communication and safety training is 0.510. This means that 51% of change in frequency of Incidence Occurrence in the bad safety performing companies within this researched area is due to change in the safety climate level; captured by safety management commitment, safety communication and safety training; implying that the remaining 49% change is due to other factors or variables that were not captured in this current model.

Table 12 also revealed that the significant level for the safety climate variables; safety management commitment, safety communication and safety training; are 0.031, 0.040 and 0.054. Using 0.05 significant level, and the rule that when significant values of any independent variable is lower than the 0.05, then such variable is a significant factor that have notable impact on dependent variable while significant values of independent variable higher than 0.05 is not significant and do not have notable impact on change in dependent variable, This means that management commitment to safety and level of safety based communication between workers and superior has significant impact on reduction of incident occurrence in the bad safety performing firms within the researched area while impact of safety training is not significant in reducing incident occurrence. On the overall, the general safety climate significant level is 0.048 which is lower than 0.05 significant limit, therefore, based on the rules, general Safety Climate has significant impact on reducing frequency of incident occurrence which means that the change in overall safety climate; captured by combination of safety management commitment, safety communication and safety training; has significant and notable impact on reduction of frequency of incident occurrence among worker in bad safety performing companies in this researched area.

Therefore, based on these results, we reject the null hypothesis which stated that “The Safety Climate does not significantly impact on frequency of incident occurrence in the selected bad

safety performing companies in Onne Oil and gas free zone” and accept the alternate hypothesis which stated that “The Safety Climate significantly impacts on frequency of Incident Occurrence in the selected good safety performing companies in Onne Oil and gas free zone”

**Table 13 The Ordinal regression statistical analysis for the significance of the relationship safety climate and frequency of accident occurrence for the Good Safety performing companies in Onne Oil and Gas Free Zone (OGFZ)**

Variables	Frequency of Accident Occurrence				
	N.	Degree of Freedom	Pseudo R-Square	Significant level (0.05)	Decision
Safety Management Committeemen	188	1	0.564	0.019	<b>Significant</b>
Safety communication	188	1	0.564	0.000	<b>Significant</b>
Safety Training	188	1	0.564	0.022	<b>Significant</b>
<b>Safety Climate</b>	188	1	0.564	0.035	<b>Significant</b>

(Source, SPSS Analysis of Researchers data 2021)

Table 13 below revealed that the Pseudo R-square value for the Safety Climate variables captured using safety management commitment, safety communication and safety training is 0.564. This means that 56.4% of change in frequency of accident Occurrence in the good safety performing companies within this researched area is due to change in the safety climate level; captured by safety management commitment, safety communication and safety training; implying that the remaining 43.6% change is due to other factors or variables that were not captured in this present model.

Table 13 also revealed that the significant level for the safety climate variables; safety management commitment, safety communication and safety training; are 0.019, 0.000 and 0.022. Using 0.05 significant level, and the rule that when significant values of any independent variable is lower than the 0.05, then such variable is a significant factor that have notable impact on dependent variable while significant values of independent variable higher than 0.05 is not significant and do not have notable impact on change in dependent variable, This implies that all the variables that were used to capture safety climate in this model (safety management commitment, safety communication and safety training) are significant variable or factors that constitute notable change on reducing frequency of accident occurrence within the good safety performing firms in this researched area. On the overall, the significant level of general safety climate is 0.035 which is lower than 0.05 significant limit, therefore, based on the rules, safety climate has significant impact on frequency of accident occurrence which means that the change in safety climate; captured by combination of safety management commitment, safety communication and safety training; has significant impact on reducing frequency of accident occurrence among worker in good safety performing companies in this researched area.

Therefore. based on these results, we reject the null hypothesis which stated that “Safety climate has no significant impact on frequency of accident occurrence in the selected companies

in Onne Oil and gas free zone” and accept the alternate hypothesis which stated that “Safety climate has significant impact on frequency of accident occurrence in the selected companies in Onne Oil and gas free zone”

**Table 14 The Ordinal regression statistical analysis for the significance of the relationship safety climate and frequency of accident occurrence for the Bad Safety performing companies in Onne Oil and Gas Free Zone (OGFZ)**

Variables	Frequency of Accident Occurrence				
	N.	Degree of Freedom	Pseudo R-Square	Significant level (0.05)	Decision
Safety Management Committeemen	176	1	0.435	0.065	<b>Not Significant</b>
Safety communication	176	1	0.435	0.081	<b>Not Significant</b>
Safety Training	176	1	0.435	0.027	<b>Significant</b>
<b>Safety Climate</b>	176	1	0.435	0.378	<b>Not Significant</b>

(Source, SPSS Analysis of Researchers data 2021)

Table 14 above revealed that the Pseudo R-square value for the Safety Climate variables which are; safety management commitment, safety communication and safety training is 0.435. This means that 43.5% of change in frequency of accident Occurrence in the bad safety performing companies within this researched area is due to change in the safety climate level; captured by safety management commitment, safety communication and safety training; implying that the remaining 56.5% changes were due to other factors or variables that were not captured in this current model.

Table 14 also revealed that the significant level for the safety climate variables; safety management commitment, safety communication and safety training; are 0.065, 0.081 and 0.027. Using 0.05 significant level, and the rule that when significant values of any independent variable is lower than the 0.05, then such variable is a significant factor that have notable impact on dependent variable while significant values of independent variable higher than 0.05 is not significant and do not have notable impact on change in dependent variable, This means that only safety training available for the workers in these companies considered has appreciable or notable impact in reducing frequency of accident occurrence while impact of management commitment on safety and safety based communication is not significant in reducing accident occurrence. On the overall, the general safety climate significant level is 0.378 which is higher than 0.05 significant limit, therefore, based on the rules, general Safety Climate has no significant impact on reducing frequency of incident occurrence which means that the change in overall safety climate; captured by combination of safety management commitment, safety communication and safety training; has no significant and notable impact on reduction of frequency of accident occurrence among worker in bad safety performing companies in this researched area. This could be confirmation of the facts that these firms are not really performing well in some key safety areas as concern management commitment to safety and level of safety-based interaction between workers and safety personals and superiors, thus making then to rank low in safety charts.

Therefore, based on these results, we accept the null hypothesis which stated that “The relationship between safety climate and frequency of accident occurrence in the selected bad performing companies in Onne Oil and gas free zone is not significant” and reject the alternate hypothesis which stated that “The relationship between safety climate and frequency of accident occurrence in the selected bad performing companies in Onne Oil and gas free zone is significant”

## **7 Discussion of Findings**

The results of this study revealed that the level of safety climate is very good in the good safety performing companies in the Onne oil and gas free zone while the level is also good in bad performing companies in the same Onne oil and gas free zone, It was expressed in the literatures that Workplace safety is determined by various intervening broad concepts that includes safety performance, safety behavior and safety climate, on which this study is based. Thus, according to Ausserhofer, *et al.* (2013) Safety climate is the concept that concerns with the description of the collective perception of workers as regards to the safety value, safety practices and safety seriousness of their organization or firm, they maintained that Safety climate is among the safety concepts that receive global attention across industry because a good level of safety climate is important in achieving safety at work place. Fogarty *et al.*, (2017) also affirmed that safety climate surveys are important tools for monitoring safety standards; and workplace errors

Based on the relationship between Safety Climate and frequency of Incident Occurrence in Onne Oil and gas free zone, the finding of this study stated that “There is high, negative and significant relationship between safety climate and frequency of Incident occurrence for the good safety performing companies in Onne Oil and gas free zone and, low, negative and significant relationship between safety climate and frequency of incident Occurrence for the bad safety performing companies in the same Onne Oil and gas free zone” This results means that increasing the safety climate level in the Onne oil and gas free through improving management commitment to safety issues, encouraging productive interaction between workers and their superiors and management and increasing and improving the nature of safety training offered to workers would reduce the frequency of occurrence of incidents among all the companies in this area, however, the Magnitude of this incident reduction is higher in the good safety performing companies compare to the poor safety performing companies. This finding concurred with empirical work of Lyu et al (2018) who in a work titled “Relationship among Safety Climate, Safety Behaviour and Safety Outcome for Ethnic Minority Construction Workers” investigated the relationships among safety climate, safety behaviour, and safety performance for EM construction workers” and their results showed that that there were significant negative relationships between safety climate and safety performance; captured using frequency of incident occurrence for EM construction workers.

The finding of this current study revealed that Safety Climate highly, negatively and significantly influenced frequency of accident occurrence among good safety performing companies across Onne Oil and gas free zone, and for the bad safety performing companies, there is low negative and insignificant impact of safety climate on frequency of accident occurrence. This means that that increasing the safety climate level in the Onne oil and gas free through improving management commitment to safety issues, encouraging productive interaction between workers and their superiors and management, and increasing and improving the nature of safety training offered to workers would reduce the frequency of occurrence of incidents among all the companies in this area, however, the Magnitude of this incident reduction is higher and noticeable in the good safety performing companies but low and insignificant in poor safety performing

companies. This finding also align with empirical work of Carol et al (2014) titled “Relationships between safety climate and safety performance of building repair, maintenance, minor alteration, and addition (RMAA) works) which was aimed at ascertaining possible relationships between safety climate and safety performance of RMAA works and to offer recommendations on ways to improve RMAA safety using SEM to develop their model in which their finding revealed that a significant negative relationship between RMAA safety climate and frequency of self-reported injuries or accidents

## 8 Conclusion

Based on these findings above, it was concluded that, there is high and significant level of safety climate among companies operating within Onne oil and gas free zone, and this significant high level of safety climate has improved safety performance by reducing frequency of accident and incident occurrence, though this improvement is more noticeable in the good safety performing companies compare to the bad safety performing companies.

## 9 Recommendations

Based on the findings and conclusion of this study, the following recommendations were made: For the good safety performing companies it was recommended that;

1. The management of these set of companies should not relent in pursuing higher safety climate by improving more on their commitment to safety of their workers, given suitable and frequency safety training to their workers and encouraging positive and open interaction between them and their workers as this would help to reduce occurrence of accidents and incidents

For the Bad Safety performing companies it was recommended that;

1. The management of these category of companies should work on improving the entire Safety climate factors in their companies as the finding of this work has confirmed that they are not really doing well in areas of their commitment to the safety of their workers, providing suitable and frequent training to their workers and encouraging positive and open interaction with their workers on safety issues, therefore resulted to insignificant reduction in frequencies of incident and accident occurrences.

## 10. References

- Ausserhofer, D., Schubert, M., Desmedt, M., Blegen, M. A., De Geest, S., & Schwendimann, R. (2013). The association of patient safety climate and nurse-related organizational factors with selected patient outcomes: a cross-sectional survey. *International Journal of Nursing Studies*, 50(2), 240-252.
- Bureau of Labour Statistics (2010). <http://www.bls.gov/iif/> retrieved 15 January 2021
- Carol, K.H., Hon, A., Chan, M., & Yam, C.H. (2014) Relationships between safety climate and safety performance of building repair, maintenance, minor alteration, and addition (RMAA) works, *Safety Science* 65, 10-19
- Fogarty, G. J., Murphy, P. J., & Perera, H. N. (2017). Safety climate in defense explosive ordnance: survey development and model testing. *Safety Science*, 93, 62-69.
- Fray, M., Waterson, P., & Munro, C. (2015). Macro and Micro Ergonomic outcomes in healthcare: Raveling the Relationship between Patient handling performance and Safety

Glendon, I., Clarke, S. H & McKenna, E. F. (2006). *Human safety and risk management*, 2nd edition. New York: Taylor & Francis. Hall, London.

Hofmann, D.A., Morgeson, F.P., & Gerras, S.J. (2003). Climate as a moderator of the relationship between leader-member exchange and content specific citizenship: safety climate as an exemplar. *Journal of Applied Psychology*. 88(1), 170–78

ILO, (2006). Occupational safety and health: synergies between security and productivity. Accessed from [http://www.ilo.org/public/english/standards/relm/gb/docs/gb29\\_5/pdf/esp-3.pdf](http://www.ilo.org/public/english/standards/relm/gb/docs/gb29_5/pdf/esp-3.pdf)

Lyu, S., Carol, K. H., Albert P. C., Francis, K. W., Wong, I., & Arshad, A., (2018). Relationship among Safety Climate, Safety Behaviour and Safety Outcome for Ethnic Minority Construction Workers. *International Journal. Environment. Research and Public Health*, 15(3), 2-16, doi:10.3390/ijerph15030484

Memarian, B. (2017). Supervisor Practices for Productivity and Safety: A Hot Asphalt Roofing Case Study, 16-30

Nevhage, B., & Lindahl, H. (2008). A Conceptual Model, Methodology and Tool to Evaluate Safety Performance in Organization, 1-17.

Nunnally, J.C & Bernstein, I.H (1994). *Psychometric Theory*; McGraw-Hill: New York, NY, USA.

Sawacha, E., Naoum, S., & Fong, D. (1999). Factors Affecting Safety Performance on Construction Sites factors Affecting Safety Performance on Construction Sites. *International Journal of Project Management*, 17(5), 309-315

World Health Organization (2008). <http://www.who.int/ccupationalhealth/en/> [www.cpwr.com](http://www.cpwr.com)