

Influence Of Organizational Factors on Safety Performance in Oil and Gas Industry in The Niger Delta Region, Nigeria

Abstract

The aim of this study was to examine the influence of organizational factors on safety performance in oil and gas companies in the Niger Delta region of Nigeria. This is a cross-sectional study using questionnaires administered electronically to employees working in these companies to gather data on various organizational factors, including management commitment, communication, leadership, and worker involvement. The reliability of the instrument was assessed using Cronbach's alpha, and path analysis was used to examine the relationships between organizational factors and safety performance. The results of the study showed that organizational factors tend to significantly influence safety compliance and participation positively, while they influence accidents and near misses negatively. These findings suggest that organizations should focus on improving organizational factors in order to enhance safety performance in the oil and gas industry.

Key words: Organizational factors, safety performance, oil and gas companies, Multinational companies, health and safety, path analysis.

1. Introduction

Organizational factors play a critical role in shaping the functioning and performance of organizations. These factors refer to the various elements of an organization that contribute to its culture, structure, processes, and overall functioning. Organizational factors can include things like leadership style, communication patterns, decision-making processes, reward system, and power dynamics, among others. Hollnagel and Woods (2005) attributed 30-40% of accidents in large complex systems to poor organizational factors. Hadikusumo *et al.* (2017) stated that occupational accidents do not only lead to the loss of properties and company assets but also result in a decrease in employee morale, quality of products and services rendered, bad public image, poor customer relationship, and also destroy company reputation. Flinet *et al.* (2000) stated that organizational factors are the leading indicators of performance in evaluating occupational safety climate. Several studies have consistently demonstrated that organizational factors are significantly associated with safety performance, and that organizations with strong organizational factors tend to have better safety outcomes

(Neal *et al.*, 2000; Oliver *et al.*; 2002; Tomas *et al.*, 1999, Hsu *et al.*, 2000). Hsu *et al.* (2000) in their study found that high management commitment to safety significantly increases safety supervision by leaders which in turn results in good safety practices by the employee. Wu *et al.* (2008) reported that safety leadership tend to influence the safety climate which in turn influences the safety performance.

Despite the importance of organizational factors, little research has been conducted on their impact on safety performance in the oil and gas industry. Further research is needed to understand the specific ways in which these factors impact safety in the oil and gas industry.

This study aims at understanding the influence organizational factors has on safety performance in the oil and gas industry in the Niger Delta region, Nigeria.

1.1. Study Hypothesis

Several researchers have outlined the importance of the influence of organizational factors on the safety performance of workers in other industries. In other studies, limited organizational factors were considered, which gave a narrow understating of how key organizational factors affect safety performance. The hypothesis to be tested involve how 9 organizational factors affect safety performance particularly in the oil and gas industry. Each of the organizational factors will be tested against the two leading safety performance indicators (safety compliance and participation). The organization factors used in this study include Communication, Empowerment, Management Commitment, leadership, Worker Involvement, Safety Rules and Procedure, safety training, OSH Monitoring, and Reward system.

H₁: Management Commitment significantly predictssafety performance.

H₂: Communication significantly predicts safety performance.

H₃: Empowerment significantly predicts safety performance.

H₄: leadership significantly predicts safety performance.

H₅: Worker Involvement significantly predicts safety performance.

H₆: Safety Rules and Procedure significantly predicts safety performance.

H₇: safety training significantly predicts safety performance.

H₈: OSH Monitoring significantly predicts safety performance.

H₉: Reward system significantly predicts safety performance.

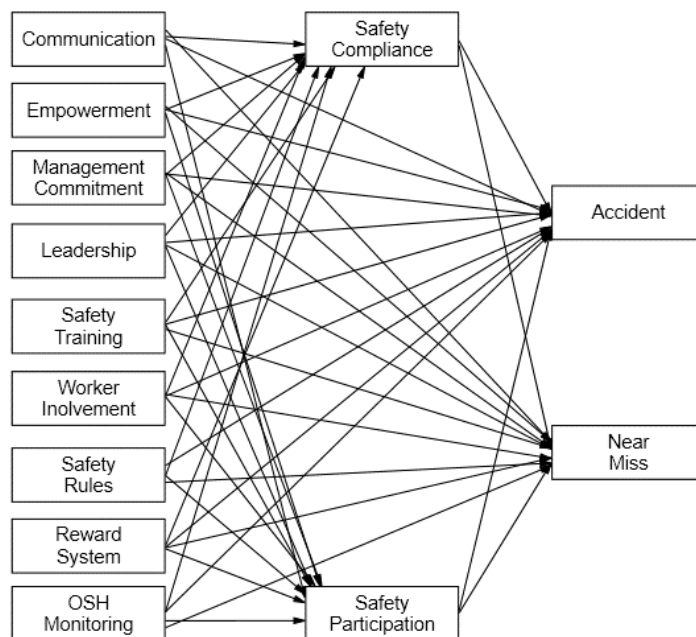


Figure 1: Hypothesis relationship among constructs

2. Methods

2.1 Participants

A total 400 questionnaires were distributed to two multinational companies and two local oil and gas production companies operating within Nigeria, in which 350 were returned (ie Completely filled). Proportional stratified sampling was employed in distributing the questionnaires. Proportionate stratified sampling means that size of sample strata is proportional to the size of population strata; in other words, probability of unit being selected

from the stratum is proportional to relative size of that stratum in population. The formula applied was $(\text{sample size}/\text{population size}) \times \text{stratum size}$. It included oil and gas workers in South-Central, Nigeria who are involved in various job roles like HSE officers, project/field Engineers, human resource, and others (such as IT support, legal support, accountants, researcher/lab scientists and administration workers). The sample size obtained for the study was 350, but a total of 400 questionnaires were distributed between the local and multinational companies in order to account for questionnaire that would not be properly filled. 177 questionnaires were distributed to local oil and gas workers while 173 questionnaires were distributed to multinational oil and gas workers. Electronic means (Microsoft form) was used in administering the questionnaires to the participants. Participants that took part in the survey were randomly selected from the employee list obtained from the company employment list.

The participants included more of oil and gas worker within the ages of 30-39 years (49.4%), while just 2.6% of the participant were between the ages of 20-29. Majority of the participant were married (82.0%) and about 96% of the participants have obtained a tertiary degree. The role designation of the participants ranged from engineers, HSE officer, Human resource, and non-technical skill workers.

2.2 Instrument

The questionnaire used for the study was a four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). The constructs for the organizational factors and safety performances were obtained from well-established organizational factors and safety performance questionnaires. The scales were further developed by rewording some items to blend with the practices in the oil and gas industry.

Communication: This measures the ease at which information flows between leaders and subordinates, and also among subordinates. Three items' questions were used in evaluating the

communication among workers in the oil and gas companies. The questions were adopted from Vecchio-Sadus (2007).

Empowerment: This measures the extent to which employees are given the autonomy, authority, and resources to make decisions and take action within their scope of work. Three items were used in measuring the empowerment of workers in the oil and gas companies. The questions under this construct were adopted from Spreitzer's (1995, 1996).

Management Commitment: This measures the extent to which leaders within an organization demonstrate a commitment to and support for the goals and values of safety in the organization. Three items were used to evaluate management's commitment to safety. The items used in the questionnaire were adopted from Vinodkumar and Bhasi (2010).

Leadership: This measures the extent to which leaders in the organization aligns with safety rules and how they implement safety instruction to their subordinates. Three items were used to evaluate the leadership that is been practiced in the oil and gas companies.

Safety training: This measures the extent to which workers undergo safety training. A total of three items were used in measuring the safety training received by the employee. The items used in this construct were adopted from Fernandez-Muniz *et al*, (2007).

Worker Involvement: This measures the extent workers are allowed to contribute to decision-making regarding safety in the organization. Three items were used in evaluating worker involvement in oil and gas industry. The three items were adopted from Vredenburg (2002).

Safety Rules and Procedure: Three items were used in measuring the safety rules and procedures that are in place in oil and gas industry in the Niger Delta region. The three items were adopted from Mullen (2004).

Reward system: This measures the extent the organization goes in rewarding good safety behaviour. Three items were used in evaluating the reward system and the items were adopted from Vredenburg (2002).

Safety compliance and participation: Three items each were used to evaluate safety participation and safety climate. The items used from both constructs were adopted from Griffin and Neal (2000).

Accident and near miss: Three items each were used in evaluating the accidents and near miss that occur in the oil and gas industry. Example of an accident item was "In the past one year, one or more of the job factors have resulted to an accident: skill variety, task identity, task significance, autonomy and feedback".

2.3 Data analysis and procedures

The responses from the participants were entered into SPSS version 26 and the coding was done according to the Likert scale used for the questionnaires. Composite scores were computed for each of the constructs and reliability was done using Cronbach alpha. Descriptive statistics were done on the composite score to understand the general view of the participants on each of the organizational factors. Pearson correlation was used to establish the relationship between the organizational factors and safety performance indicators. Path analysis was used in modelling the relationship between the organizational factors and safety performance indicators.

3. Results

3.1 Descriptive and Reliability of construct

The reliability of the organizational, job, and safety performance factors was assessed using Cronbach alpha, and the results are presented in Table 1. The results of the Cronbach alpha for the organizational factors indicate that most of the indicator variables used to measure the latent constructs were reliable. The Cronbach alpha ranged from 0.411 to 0.924, with safety training having the highest internal consistency at 0.924, while safety culture had the lowest reliability at 0.411. According to Nunnally (1978), Cronbach alpha values above 0.70 are generally considered acceptable, although values above 0.80 are considered ideal. For the safety performance factors, both leading and lagging indicators were used. The indicator variables for the leading indicators (safety compliance and participation) had very high internal consistency, with Cronbach alpha values of 0.80 and 0.819 respectively. The lagging indicator (accidents and near misses) also had relatively high internal consistency, with Cronbach alpha values of 0.844 and 0.903, respectively. The only construct that was not considered reliable was communication, which had a marginally reliable Cronbach alpha value.

The result from the descriptive statistics showed that majority of the respondents agreed to the fact that management is committed to the safety of the worker, leader in the organization uphold safety rules and ensure safety rules are followed by their subordinate, and there is good open communication about safety in their workplace. Most of the respondents stated that they have not been involved in near misses or accidents, but this value should be considered to be underreported as workers tend not like reporting accidents or downplay events such as near misses.

Table 1: Descriptive statistic and Cronbach alpha for all constructs (4-point Likert scale)

Groups	Constructs	Mean	Std. Dev	Cronbach Alpha	Standardized Cronbach Alpha
Organizational Factors	Communication (Comm)	3.54	0.43	0.400	0.401
	Empowerment (Emp)	3.37	0.49	0.665	0.685

ST	0.67	0.46	0.65	0.42	1.00								
WI	0.83	0.76	0.63	0.69	0.74	1.00							
SRP	0.70	0.65	0.79	0.52	0.70	0.68	1.00						
RS	0.36	0.49	0.62	0.23	0.52	0.45	0.48	1.00					
OSHmon	0.57	0.66	0.85	0.32	0.62	0.63	0.85	0.61	1.00				
SC	0.69	0.69	0.38	0.67	0.44	0.73	0.56	0.25	0.40	1.00			
SP	0.51	0.72	0.27	0.49	0.07	0.48	0.24	0.22	0.25	0.52	1.00		
ACC	-0.55	-0.42	-0.51	-0.24	-0.13	-0.45	-0.29	-0.13	-0.37	-0.31	-0.37	1.00	
NM	-0.52	-0.43	-0.60	-0.19	-0.20	-0.48	-0.49	-0.14	-0.53	-0.32	-0.29	0.85	1.00

Values in bold are different from 0 with a significance level $\alpha=0.05$

3.3 Path Analysis

The theoretical (initial) model as shown in Table 3 did not produce a good fit for the dataset. In order to obtain a good fit, a slight modification of the initial model was done. A correlation was added to the error terms for the accidents and near misses, which improved the model significantly. The modified model was named revised model 1 as shown in Table 3, and the goodness of fit showed improvement. The CFI, GFI, SRMR, and RMSEA were within the recommended values. The CFI and GFI were greater than 0.9, the RMSEA was less than 0.09 which signifies an adequate fit. The result from the path analysis is shown in Table 4. The result showed that management commitment had a positive relationship with safety participation and safety compliance. Communication had a positive relationship with safety compliance and participation. The relationship between management commitment and accidents showed a negative relationship. For the relationship between worker involvement and safety compliance, a significant positive relationship was established. There was also a significant positive relationship between empowerment and the leading safety performance indicators

Table 3: Goodness of Fit of the Model

Models	χ^2	df	CFI	GFI	RMSEA	SRMR
Initial Model	435.917	2	0.916	0.899	0.791	0.0302
Revised Model 1	7.968	1	0.999	0.997	0.084	0.0053

χ^2 = Chi-Squared, df = degree of freedom, CFI = Comparative fit index, GFI = Goodness of fit index, RMSEA = Root Mean Square Error of Approximation

Table 4: Relationship between the organizational factors and the safety performance from the path model.

Path	Standardized Regression Weight	Regression Weight	S.E.	P
SC <--- Comm	0.232	0.209	0.06	***
SC <--- Emp	0.357	0.284	0.049	***
SP <--- Emp	0.934	0.926	0.06	***
SP <--- MC	0.425	0.318	0.056	***
SP <--- Lead	0.091	0.099	0.058	0.089
SC <--- ST	0.154	0.083	0.029	0.004
SP <--- ST	0.327	0.22	0.035	***
SP <--- WI	0.026	0.019	0.052	0.71
SC <--- SRP	0.178	0.146	0.06	0.015
SP <--- SRP	0.396	0.404	0.074	***
SP <--- RS	0.06	0.057	0.04	0.149
SP <--- OSHmon	0.302	0.252	0.063	***
SP <--- Comm	0.164	0.184	0.074	0.013
SC <--- MC	0.552	0.331	0.060	***
SC <--- Lead	0.106	0.093	0.047	0.049
SC <--- WI	0.426	0.254	0.042	***
SC <--- RS	0.051	0.039	0.032	0.222
SC <--- OSHmon	0.267	0.179	0.051	***
ACC <--- Comm	-0.56	-0.917	0.129	***
NM <--- Comm	-0.495	-0.828	0.122	***
ACC <--- Emp	-0.291	-0.42	0.135	0.002
NM <--- Emp	-0.391	-0.576	0.129	***
ACC <--- MC	-0.928	-1.01	0.099	***
NM <--- MC	-0.65	-0.723	0.095	***
ACC <--- Lead	-0.132	-0.209	0.099	0.034
NM <--- Lead	-0.055	-0.09	0.094	0.34
NM <--- ST	-0.771	-0.772	0.06	***
ACC <--- SRP	-0.627	-0.93	0.131	***
NM <--- SRP	-0.114	-0.173	0.124	0.163
NM <--- RS	-0.33	-0.471	0.064	***
ACC <--- OSHmon	-0.017	-0.021	0.11	0.847
NM <--- OSHmon	-0.076	-0.095	0.105	0.367
ACC <--- ST	-0.644	0.631	0.063	***
ACC <--- WI	-0.349	-0.378	0.092	***
NM <--- WI	-0.599	-0.664	0.088	***
ACC <--- RS	-0.251	-0.35	0.067	***

*** represent that the p-value <0.001

4. Discussion

The findings from the result showed that if management and top executives in oil and gas companies in the Niger Delta region should increase the commitment to safety in these organization, it will significantly lead to increase in safety compliance and participation of

employees. Management commitment to safety tends to make the organization put effective safety policies which in turn make the employee comply with safety rules and regulations and actively participate in safety related activities such as attending safety meetings and campaigns. The finding tends to suppose Hypothesis 1a which state that management commitment significantly predicts safety performance. The finding in this study was in line with findings from other studies done on the influence of organizational factors on safety performance. Hsu *et al.* (2010) reported that management commitment to safety tends to affect the safe practice of employees through safety supervision. The result also showed that management commitment to safety has a diminishing effect on the number of accidents and near misses.

Open communication between the top executives and the subordinate showed a significant positive relationship which supports Hypothesis 2. Open communication about safety issues helps in making the employee more engaged in safety issues and safety-related activities. Open communication also helps in understanding employee confusion about certain safety policies and rules set by management which in turn prevents employees from breaking those set of rules and regulations. There was a significant positive association between empowerment and safety compliance and participation which supports Hypothesis 3. When employees are given autonomy to take key decision regarding their task, it leads to motivation, and employees are more engaged in their task which in turn lead to a higher rate of compliance and participation. Giving autonomy to employees results in the workers being more likely to comply with safety policies and procedures due to the sense of responsibility that has been bestowed on them. Moreover, the result showed that leadership has a more significant effect on employees complying with safety rules and regulations than participating in safety meetings. Findings from the study showed that Hypothesis 4 was not supported. The relationship between worker involvement and safety performance was not supported. There

was no significant relationship between worker involvement and safety participation, but a significant relationship was established between worker involvement and safety compliance.

5. Conclusion

The findings from this study which tried to understand the influence organizational factors on safety performance showed that majority of the organizational factors tends to influence leading safety performance indicators (compliance and participation) significantly and positively. Findings also revealed that organization factor tends to negatively influence the lagging safety performance indicators (accidents and near misses). Organizations should focus on maintaining good level of organizational factors in other to improve the general safety in oil and gas companies operating in the Niger Delta region of Nigeria.

References

- Fernández-Muñiz, B., Montes-Peón, J. M., and Vázquez-Ordás, C. J. (2007). Safety culture: Analysis of the causal relationships between its key dimensions. *Journal of safety research*, 38(6), 627-641.
- Flin, R.; Mearns, K.; O'Connor, P.; & R. Bryden (2000). Measuring safety climate: identifying the common features. *Safety Science*, 34(1-3), 177-192. doi:10.1016/s0925-7535(00)00012-6
- Griffin, M. A., and Neal, A. (2000). Perceptions of safety at work: a framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of occupational health psychology*, 5(3), 347.
- Hadikusumo, B., Jitwasinkul, B.; & Abdul, M. (2017). Role of Organizational Factors Affecting Worker Safety Behavior: A Bayesian Belief Network Approach. *Procedia Engineering*, 171(), 131-139. doi:10.1016/j.proeng.2017.01.319.
- Helmreich, R. L., & Merritt, A. C. (2001). *Culture at Work in Aviation and Medicine: National, Organizational and Professional Influences (1st ed.)*. Routledge. <https://doi.org/10.4324/9781315258690>.
- Hollnagel, E., & Woods, D.D. (2005). *Joint Cognitive Systems: Foundations of Cognitive Systems Engineering (1st ed.)*. CRC Press. <https://doi.org/10.1201/9781420038194>
- Hsu, S.; Lee, C. Wu, M.; & Takano, K. (2010). The influence of organizational factors on safety in Taiwanese high-risk industries. *Journal of loss Prevention in the Process Industries*, 23(5), 646-653. doi:10.1016/j.jlp.2010.06.018

- Kines P. (2011) Safety Climate Questionnaire (NOSACQ-50): A new tool for diagnosing occupational safety climate. *International Journal of Industrial Ergonomics*, 13.
- Mearns, K & Yule, S (2009). The role of national culture in determining safety performance: Challenges for the global oil and gas industry. *Safety Science*, 47(6), 777–785. doi:10.1016/j.ssci.2008.01.009.
- Mullen, J. (2004). Investigating factors that influence individual safety behaviour at work. *Journal of Safety Research*, 35, 275-285.
- Neal, A.; Griffin, M; & Hart, P. (2000). The impact of organizational climate on safety climate and individual behaviour. *Safety Science*, 34(1-3), 99–109. doi:10.1016/s0925-7535(00)00008-4.
- Nunnally, J.C., 1978. *Psychometric Theory*, 2nd ed. McGraw-Hill, New York.
- Oliver, A., Cheyne, A., Tomas, J., & Cox, S. (2002). The effects of organizational and individual factors on occupational accidents. *J. Occup. Organ. Psychol.* 75, 473–488.
- OPEC. (2014, March). World oil demand just keeps on rising. https://www.opec.org/opec_web/en/press_room/2777.htm.
- Spreitzer, G. M. (1995). Individual empowerment in the workplace: Dimensions, measurement, and validation. *Academy of Management Journal*, 38, 1442-1465.
- Spreitzer, G. M. (1996). Social structural characteristics of psychological empowerment. *Academy of Management Journal*, 39, 483-504.
- Tomas, J. M., Melia, J. L., & Oliver, A. (1999). A cross-validation of a structural equation model of accidents: organizational and psychological variables as predictors of work safety. *Work Stress* 13, 49–58.
- Vecchio-Sadus, A. M. (2007). Enhancing safety culture through effective communication. *Safety Science Monitor*, 11(3), 1-10.
- Vinodkumar, M. N.; & Bhasi, M. (2010). Safety management practices and safety behaviour: Assessing the mediating role of safety knowledge and motivation. *Accident Analysis and Prevention*, 42(6), 2082–2093. doi:10.1016/j.aap.2010.06.021.
- Vredenburgh, A. G. (2002). Organizational safety: which management practices are most effective in reducing employee injury rates?. *Journal of safety Research*, 33(2), 259-276.
- Wu, T.; Chen, C.; & Li, C. (2008). A correlation among safety leadership, safety climate and safety performance. *Journal of Loss Prevention in the Process Industries*, 21 (2008) 307–318. doi:10.1016/j.jlp.2007.11.001