



Organizational Factors and Safety Performance Levels among Local and Multinational Oil and Gas Companies in the Niger Delta Region of Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/CJAST/2023/v42i14047

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/95803>

Original Research Article

Received: 28/10/2022

Accepted: 30/12/2022

Published: 31/01/2023

ABSTRACT

The purpose of this study was to investigate the level of organizational factors and safety performances among local and multinational oil and gas companies in the Niger Delta region of Nigeria. This is a cross-sectional study for which questionnaires were used as the instrument to gather data from employees in both local and multinational companies. Principal component analysis was used to understand the relationship between the organizational factors and the Oil and Gas Company types. Mann-Whitney test was used to check for significant differences in the organizational factors between the two types of companies. The mean response for management commitment for local and multinational companies were 3.34 and 3.56 respectively. For safety participation, the mean response for local and multinational companies were 3.33 and 3.62

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respectively. The results of the study showed that multinational companies had a significantly higher level of organizational and safety performance factors compared to local companies. These organizational factors included management commitment to safety, safety policies/procedures, safety training, and communication. The findings of this study suggest that national culture may play a role in shaping the organizational factors and safety performance of oil and gas companies. Multinational companies, which operate in a variety of different cultural contexts, may be better equipped to adapt to different safety regulations and cultural expectations, which may contribute to their higher levels of organizational factors related to safety. Further research is needed to understand the specific ways in which national culture may influence safety performance in the oil and gas industry.

Keywords: Organizational factors; safety performance; oil and gas companies; multinational companies; health and safety.

1. INTRODUCTION

Oil and gas exploration has been vital in keeping civilization and modern society running. With the continuous rise in the global demand for oil and gas, there is a need for the discovery of oil and gas fields in other regions of the world. The annual average world demand has risen from 21.4 million barrels/day in 1960 to 89.9 million barrels/day in 2013 and it is projected to rise to 108.5 million barrels/day in 2035 [1]. In order to meet this growing demand for oil and gas, most established oil and gas companies' e.g., Exxon Mobil, BP, and Shell have ventured into looking for productive oil fields outside the countries where the companies were founded. This has resulted in these oil and gas companies working in areas that are geographically and culturally diverse from their own countries of origin. With this cultural diversity in the host country's workforce come different values, beliefs, training, education, and experience [2]. The diversity of the host country's workforce would lead to different levels of perception about safety and the level at which organizational factors such as communication, leadership, worker involvement, etc. are held. The problem of the oil and gas workforce having different beliefs, values, and training is further compounded by the fact that most OPEC countries are now localizing their oil exploration and production as the government gives licences to local companies. This results in the localized oil and gas companies not upholding high organizational factors standards which might eventually result in safety issues in the companies. The oil and gas industry is one of the most demanding and hazardous industries, therefore safety should be one of the most important factors that should be upheld in the industry. Oil and gas companies must ensure the safety of workers by having good organizational factors. Several studies have revealed that organizational factors tend to affect employee

safety behaviours [3,4,5]. Organizational factors and safety are mostly influenced by cultural beliefs and the value society places on safety. Helmreich and Merrit, [6] stated that organizational factor tends to be influenced by external factors such as the economy of the country, the socio-technical environment and the national culture. Mearns and Yule [2] stated that in some countries, the political regime may perceive labour as cheap and dispensable but for western organizations operating in these countries, the moral and ethical obligation associated with protecting people from harm at work should be a sufficiently strong motivating force to ensure implementation of effective safety management systems that goes beyond local legislative requirements.

This research attempts to compare the organizational factors and safety levels of local oil and gas companies operating in Nigeria against their multinational counterparts. This will provide bases for cross-pollination of learnings among the company categories.

1.1 Study Hypothesis

Organizational factors and safety performance levels at companies are affected by national culture and geographical location. The hypothesis to be tested suggest that national culture tends to have a significant role in the level of organizational factors and safety performance among workers in the oil and gas industry.

Null Hypothesis H_0 : Cross-cultural employers have no significant influence on the organizational factor and safety performance.

Alternative Hypothesis H_1 : Cross-cultural employers have a significant influence on the organizational factor and safety performance.

2. METHODS

2.1 Participants

Questionnaires were distributed to two multinational companies and two local oil and gas production companies operating within Nigeria. Proportional stratified sampling was employed in distributing the questionnaires. Proportionate stratified sampling means that the size of the sample strata is proportional to the size of the population strata; in other words, the probability of a unit being selected from the stratum is proportional to the relative size of that stratum in the population. The formula applied was $(\text{sample size}/\text{population size}) \times \text{stratum size}$. It included oil and gas workers in South-South, 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 questionnaires 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 mean (Microsoft form) was used in administering the questionnaires to the participants.

2.2 Instrument

All questions in the questionnaire used for the study were on 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. The validity of the items under each construct was evaluated using content validity. Two academics and one field expert in the health and safety profession evaluated each item under the constructs for readability, clarity, and comprehensiveness. An agreement was reached by the experts based on a rating system on the suitability of items which was used in the questionnaire.

Communication: This measures the ease at which information flows between leaders and subordinates, and among subordinates. Three

items' questions were used in evaluating the safety communication among workers in the oil and gas companies. The questions were adopted from Vecchio-Sadus [7], an item in the construct include "There is open communication about safety issues in my workplace".

Empowerment: This measures the extent to which employees are given the autonomy, authority, and resources to make decisions and act 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 [8,9] "psychological empowerment perception" inventory. An example of the items is "Workers are given autonomy to make decisions about a certain aspect of their task".

Management commitment: This measures the extent to which leaders within an organization demonstrate a commitment to and support 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 adapted from Vinodkumar and Bhasi [10]. An example of an item included in this construct is "Safety is given high priority by the management".

Leadership: This measures the extent to which leaders in the organization align with safety rules and how they implement safety instructions to their subordinates. Three items were used to evaluate the leadership that is been practiced in the oil and gas companies. An example of an item included in this construct is "Active role of leadership strongly influences the safe work behaviour of their subordinates".

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, [11]. An example of an item included in this construct is "My company gives comprehensive training to the employees in workplace health and safety issues".

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 the oil and gas industries. The three items were adopted from Vredenburg [12]. An example of an item in this construct is "Management always welcomes opinion from

employees before making final decisions on safety-related matters”.

Safety rules and procedure: Three items were used in measuring the safety rules and procedures that are in place in these oil and gas industries in the Niger Delta region. The three items were adopted from Mullen [13]. An example of an item in this construct is “The safety procedures and practices in this organization are useful and effective”.

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 [12]. An example of the items in this construct is “My company provides a tangible reward for following occupational safety and health (OSH) protocols and procedures”.

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 [14]. An example of a safety compliance item is “I use all necessary safety equipment to do my job” while that of safety participation is “I help my co-workers when they are working under risky or hazardous conditions”.

Accident and near miss: Three items each were used in evaluating the accidents and near-miss that occur in the oil and gas industry. An example of an accident item was “In the past one year, one or more of the job factors have resulted in 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. The standardized Cronbach alpha was also obtained using the statistical package SPSS version 26. Principal component Analysis was carried out on the composite score in order to reduce the dimensions of the organizational factors and safety performance. The Oil and Gas Company types were used as a supplementary variable to understand the level of organizational factors and safety performance based on the oil and gas company type. Mann-Whitney test which is a

non-parametric test was used to understand if the level of organization factor and safety performance was significant between the oil and gas companies.

3. RESULTS

3.1 Cronbach Alpha Analysis

The reliability of the organizational, job, and safety performance factors was assessed using Cronbach alpha and the result is presented in Table 1. The result of the Cronbach alpha for the organizational factors indicated that most of the indicator variables used in measuring the latent constructs were reliable. The Cronbach alpha ranged from 0.411 to 0.924, with safety training having the highest internal consistency with a Cronbach alpha of 0.924 while safety culture had the lowest reliability with a Cronbach alpha of 0.411. As a rule of thumb, Nunnally [15] suggested that coefficient alpha values 0.70+ are acceptable but should not be considered to be a fixed cut-off point. Cronbach alpha closer to 0.7 are still considered to have good internal consistency but alpha values greater than 0.80 are considered to be ideal.

For safety performance, both leading and lagging indicators were used in evaluating safety. For the leading indicators (safety compliance and participation), the indicators variables used in measuring the two constructs gave very high internal consistency. The Cronbach alpha for safety compliance and participation were 0.80 and 0.819 respectively. For the lagging indicator (accident and near miss) the internal consistency was also relatively high. The Cronbach alpha for accidents and near-miss were 0.844 and 0.903 respectively. All the constructs are reliable except “communication and safety culture” which are marginally reliable.

3.2 Principal Component Analysis, PCA

PCA was used to understand the relationship between the organizational and safety performance factors and the oil company type (local or multinational). The result of the Bartlett Sphericity test and Kaiser-Meyer-Olkin test shown in Table 2 showed that there was some sort of correlation between the organizational factor and safety performance and the null hypothesis was rejected which state that the correlation matrix is an identity matrix.

The result from the Bartlett Sphericity test and Kaiser-Meyer-Olkin test provided sufficient

evidence to analyze the data set using PCA. Table 3 presents the result of the Eigenvalue and proportion of variance retained before and after varimax rotation. Adopting the Kaiser-Guttman criterion, the first three principal components were retained since they all have an eigenvalue greater than 1. The proportion of variance retained by the first three components were all greater than 10% and the cumulative proportion of variance retained by the three component was 67.74%. For ease of interpretation of the factor loading, the factor loading solution was rotated by adopting varimax rotation and the result of the rotated solution is presented in Table 4.

A factor scores greater than 0.45 was set to be the threshold value to determine which organizational or safety performance variables load strongly on the principal component. The result from Table 3 showed that seven organizational factor variables loaded strongly on the first principal component while four variables loaded strongly on the second principal component. Two variables which were accidents and near-miss loaded strongly on the third principal component. A supplementary variable which was the company type was used to understand the relationship between the organizational or safety performance factor and

the type of oil and Gas Company. The result of the relationship between the organizational factors and company type for principal components 1 and 2 is presented in the biplot shown in Fig. 1. The result from Fig. 1 showed that the multinational companies had a higher level of organizational factors than the local companies, as the multinational company was closer to the organizational and safety performance factor than the local company. The result of the biplot showed that the multinational companies had a higher level of management commitment to safety than the local company which implies that the top management and executives in multinational oil and gas companies tend to show real concern towards the safety of their employees than the management and executives of the companies. The result from the biplot also shows that stronger leadership is demonstrated in multinational companies than in local companies, which implies that the leaders in multinational companies lead by example in complying with safety rules and also hold their subordinates accountable for rule-breaking. Higher level of safety training (ST), worker involvement (WI), OSH monitoring, and commitment to safety were recorded in the multinational companies than the local companies.

Table 1. Cronbach alpha for construct

Groups	Constructs	Cronbach alpha	Standardized cronbach alpha	Internal consistency
Organizational factors	Safety culture	0.411	0.515	Poor
	Communication	0.400	0.401	Poor
	Empowerment	0.665	0.685	Good
	Management commitment	0.924	0.930	Good
	Leadership	0.722	0.734	Good
	Safety training	0.943	0.945	Good
	Worker involvement	0.909	0.909	Good
	Safety rules and procedures	0.613	0.653	Good
	Reward system	0.575	0.561	Fair
Safety behaviour	OSH monitoring	0.703	0.704	Good
	Safety compliance	0.800	0.806	good
Safety outcomes	Safety participation	0.819	0.830	good
	Accidents	0.844	0.848	good
	Near-Miss	0.903	0.909	good

Table 2. Bartlett sphericity test and kaiser-meyer-olkin test

Statistical Test	Statistic	Value
Bartlett's sphericity test	Chi-square (Observed value)	3324.577
	Chi-square (Critical value)	114.268
	DF	91
	p-value	< 0.0001
	alpha	0.05
Kaiser-Meyer-Olkin	KMO	0.743

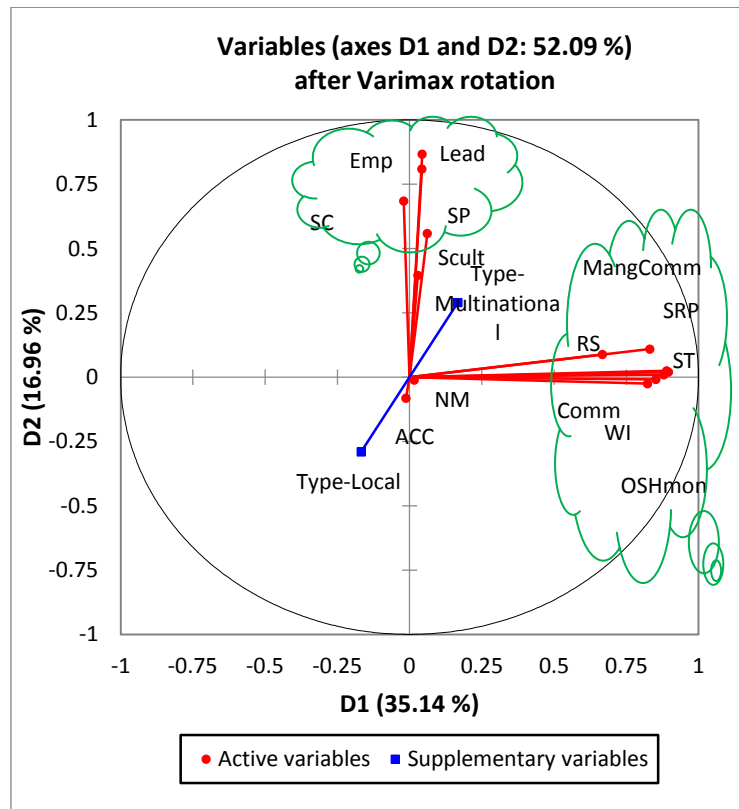


Fig. 1. Biplot showing the relationship between the organizational factor and safety performance against the oil company type for principal components 1 and 2

The result of the relationship between the organizational and safety performance factor against the type of oil and gas company for principal components 2 and 3 is shown in Fig. 2. The result shows that the multinational companies demonstrate a higher level of safety compliance and participation than the local companies as the multinational companies were closer to safety compliance and participation as shown in Fig. 2. Employees in multinational companies are more likely to exhibit better behaviour such as wearing personal protective equipment when carrying out their tasks and complying with safety rules and regulations. Also, employees in multinational companies demonstrated greater participation in safety-related activities such as safety meetings and safety campaigns than their counterparts from the local oil and gas companies. In terms of accidents and near-miss, the result from the biplot showed local companies tend to be involved in more accidents and near-misses than multinational oil and gas companies. The high levels of accidents and near-miss recorded among local oil and gas employees can be attributed to the lower safety compliance and participation recorded among them. Several

Studies have shown that there is a negative relationship between safety compliance and participation when compared with accidents and near-miss.

3.3 Descriptive Statistic and Test of Significance Using the Mann-Whitney Test

The result of the descriptive statistic is presented in Table 5, and showed that mean management commitment responses for the local and multinational companies were 3.34 and 3.56 respectively. For communication, the mean response for the local and multinational companies were 3.53 and 3.56 respectively. For safety participation, the mean response for local and multinational were 3.33 and 3.62 respectively. The result for other organization and safety performance factors are shown in Table 5. In other to investigate the statistical significance of the higher level of organizational factors recorded in multinational companies when compared with the local companies, the Mann-Whitney test was used and the significant level is shown in Figs. 3 and 4. The Mann-Whitney test which is a non-parametric test was

used due to the violation of normality and equality of variance. The result from Fig. 3 showed that the multinational companies recorded a significantly higher level of management commitment than the local companies with a $p\text{-value} < 0.0001$. For empowerment (emp), leadership (lead), safety culture (Scult), safety training (ST), safety rules and procedure (SRP), and reward system (RS). Significantly higher levels were recorded at the multinational companies than the local companies. No significant difference was recorded for communication (comm), worker involvement (WI), and OSH monitoring which indicate that both the multinational and local oil and gas companies have similar levels of these organizational factors.

The result of the Mann-Whitney test of significance for safety performance is presented in Fig. 4. For the safety performance factors, the result showed that the employees at the multinational companies significantly had a higher compliance rate; like complying with the use of PPE and abiding by safety rules. For safety participation, employees at multinational companies significantly exhibited indirect behaviours that could improve the general safety at the workplace than the local employee.

The consequence associated with poor safety behaviour such as accident and near misses showed that employees at the local companies is more likely to be significantly involved in accidents than employees in multinational companies. There was no significant difference when considering near misses in both local and multinational companies.

4. DISCUSSION

The research identified that local oil and gas companies have a much lower level of organizational factors than multinational companies. Management commitment level was found to be significantly higher in multinational companies than in local oil and gas companies; this finding indicates that top management and executive in multinational oil and gas companies leans towards prioritizing the safety and well-being of their workers than the management of the local oil and gas companies. The higher commitment to safety observed at multinational companies can be attributed to larger resources in the multinationals when compared with the local companies. This enables the multinational companies to invest more in the safety of their

organization. Multinational oil and gas companies also have more experience in the setting and implementation of safety policies than local companies. The finding from this study supports the research hypothesis, that cultural diversities tend to affect organizational factors in oil and gas companies. Arooj et al. [16] also observed that the management of multinational power companies in Pakistan had a higher level of management commitment to safety than the local companies. A high level of management commitment to safety has been shown to foster more willingness by the employee to report safety issues, better team collaboration, and more efficient supervision from the safety supervisors and line manager [17]. A significant reward system was also practiced more in multinational companies than local companies which could be attributed to the fact that multinational companies tend to have more resources to reward good safety behaviour than local companies.

For empowerment, the result indicates that management of the multinational companies tends to trust their workers more than the management of local companies and the difference in the mean was significant. The result gives an indication that workers in multinational companies are given more decision latitude when carrying out their task. Arooj et al. [16] reported that multinational companies provided more management safety empowerment to their workers than local companies. Several studies have shown that higher decision latitude increases job satisfaction, improves performance, and enhances creativity. Kines [18] stated that managers should improve their belief in employees' ability to competently deal with safety issues when it arises in the performance of their task.

A higher role of leadership in terms of safety issues was exhibited in multinational oil and gas companies than in local companies, and the mean difference was significant. The finding from this study shows that the leaders in multinational companies tend to set clear safety goals and expectations, encourage employee engagement and involvement, and demonstrate a personal commitment to safety. From the study, out of the 10 organizational factors measured, the multinational companies had higher levels of performance than the local companies. Arooj et al. [16] reported that multinational companies also had better safety culture than the local power companies in Pakistan. Out of the 10

measured organizational factors, the mean difference of seven of the organizational factors was significantly different from zero. The result from the test of significance provides sufficient evidence in stating that cross-cultural employers tend to significantly affect organizational factors.

In terms of safety performance, it was observed that the safety behaviour in multinational companies was significantly better than that of local companies. Employees in multinational

companies comply more with safety directives such as following procedures, rules and regulations and wearing PPEs when carrying out their tasks. The result also gives indications that poor organization factors practiced by companies and poor safety behaviour by employees result in higher accidents and near misses. The higher levels of accidents and near misses observed in the local companies can be attributed to the lower levels of organizational factors and safety behaviour.

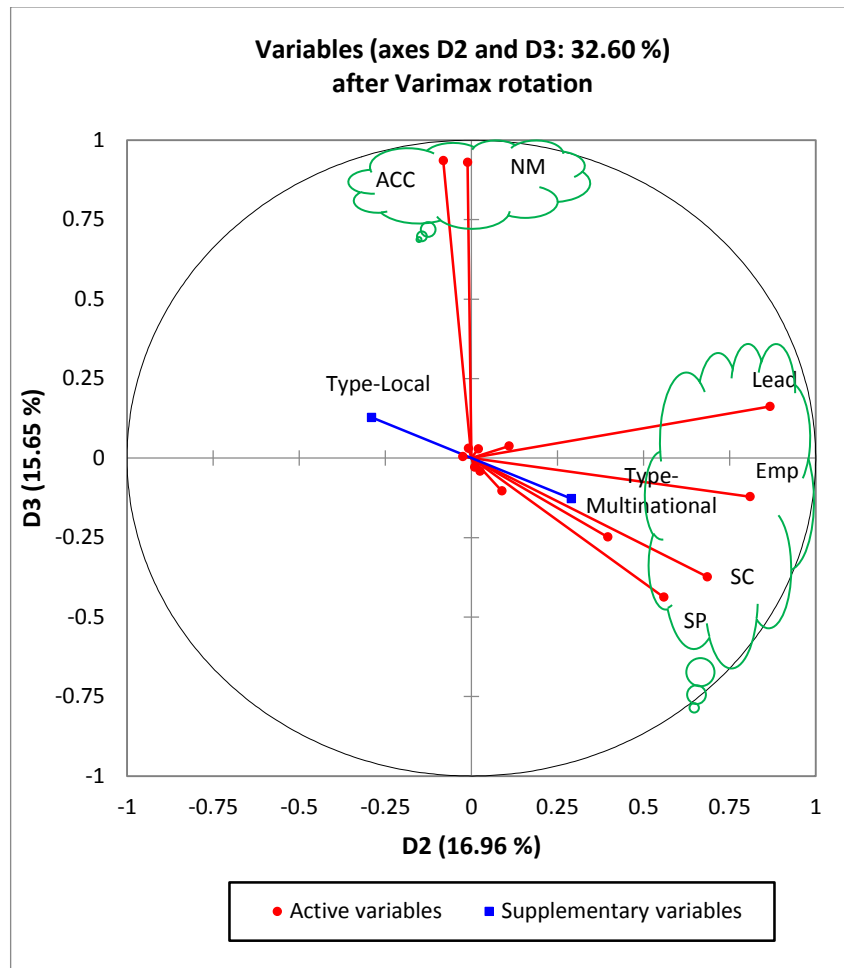


Fig. 2. Biplot showing the relationship between the organizational factor and safety performance against the oil company type for principal components 2 and 3

Table 3. Eigenvalue and proportion of variance before and after varimax rotation

Components	Eigenvalue	Before Varimax Rotation		After Varimax Rotation	
		Variability (%)	Cumulative Variability (%)	Variability (%)	Cumulative Variability (%)
PC1	4.955	35.393	35.393	35.135	35.135
PC2	2.907	20.762	56.154	16.955	52.091
PC3	1.622	11.586	67.740	15.649	67.740
PC4	0.942	6.727	74.467	6.727	74.467

PC1 = Principal Component 1; PC2 = Principal Component 2; PC3 = Principal Component 3; PC4 = Principal Component 4

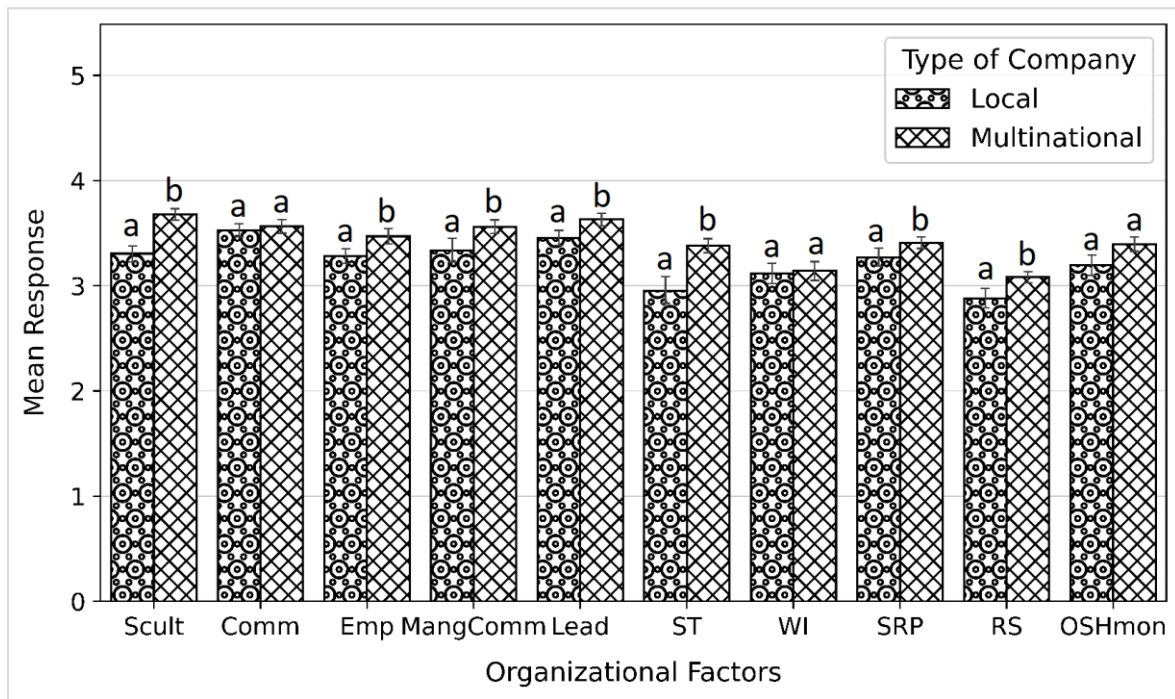


Fig. 3. Mean and standard deviation responses to organizational factors for local and multinational companies (4-point Likert scale). Different annotation indicates a statistically significant difference between the means at P-values < 0.05 while same annotation has no significant difference



Fig. 4. Mean and standard deviation responses to safety performance for local and multinational companies (4-point Likert scale). Different annotation indicates a statistically significant difference between the means at P-values < 0.05 while same annotation has no significant difference

Table 4. Factor loading after varimax rotation

Organization and safety performance factors	Abbreviations	PC1	PC2	PC3
Safety Culture	Scult	0.029	0.396	-0.248
Communication	Comm	0.824	-0.025	0.005
Empowerment	Emp	0.043	0.809	-0.121
Management Commitment	MangComm	0.890	0.025	-0.041
Leadership	Lead	0.043	0.867	0.162
Safety Training	ST	0.831	0.109	0.038
Worker Involvement	WI	0.852	-0.009	0.031
Safety rules and procedures	SRP	0.896	0.020	0.029
Reward system	RS	0.667	0.088	-0.103
OSH Monitoring	OSHmon	0.880	0.009	-0.028
Safety Compliance	SC	-0.020	0.685	-0.374
Safety Participation	SP	0.061	0.559	-0.437
Accidents	ACC	-0.013	-0.082	0.936
Near-miss	NM	0.016	-0.011	0.930
	Type-Local	-0.167	-0.290	0.128
	Type-Multinational	0.167	0.290	-0.128

Table 5. Descriptive statistic of organizational factors

Organizational and safety performance factors	Type	Total count	Mean	StDev
Safety Culture	Local	177	3.3051	0.5469
	Multinational	173	3.6782	0.3681
Communication	Local	177	3.5254	0.4172
	Multinational	173	3.5636	0.4433
Empowerment	Local	177	3.2806	0.4804
	Multinational	173	3.4701	0.4781
Management Commitment	Local	177	3.3352	0.7708
	Multinational	173	3.5588	0.4713
Leadership	Local	177	3.4557	0.4775
	Multinational	173	3.632	0.3906
Safety Training	Local	177	2.951	0.8683
	Multinational	173	3.3815	0.4442
Worker Involvement	Local	177	3.1186	0.6893
	Multinational	173	3.1426	0.6144
Safety rules and procedures	Local	177	3.2674	0.5517
	Multinational	173	3.4085	0.3939
Reward system	Local	177	2.8814	0.6033
	Multinational	173	3.0809	0.3593
OSH Monitoring	Local	177	3.1977	0.6829
	Multinational	173	3.3969	0.4422
Safety Compliance	Local	177	3.5838	0.4137
	Multinational	173	3.7013	0.4115
Safety Participation	Local	177	3.3258	0.4949
	Multinational	173	3.6243	0.4262
Accidents	Local	177	2.3465	0.7363
	Multinational	173	2.104	0.6525
Near-miss	Local	177	2.3635	0.7285
	Multinational	173	2.316	0.7254

5. CONCLUSION

The findings from the study showed that the multinational companies had better organizational factors and safety performance than the local companies. The mean response for management commitment for local and multinational companies were 3.34 and 3.56 respectively. For safety participation, the mean response for local and multinational companies were 3.33 and 3.62 respectively. The result from the test of significance provided sufficient evidence in confirming the hypothesis of the researcher that national culture tends to play a role in organizational factors and safety performance. Companies with an operational base in more than one country tend to generally have better organizational factors that promote better safety performance. The results from this study also highlight the need for the local companies in the Niger Delta region to glean leanings around the success factors of the multinational companies in this area and use those learnings in the improvement of their organizational factors and safety performance.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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