

IMPACT OF SAFETY CULTURE ON EMPLOYEES’ PRODUCTIVITY IN SELECTED OIL AND GAS COMPANIES IN RIVERS STATE

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ABSTRACT

This study assessed the impact of safety culture on employees’ productivity in five selected indigenous oil and gas companies in Rivers State, Nigeria. Using a mixed-methods cross-sectional design, 366 structured questionnaires were distributed across managerial, engineering/operational, administrative, and HSE cadres, yielding 333 usable responses (90.98% valid response rate), complemented by 12 semi-structured qualitative interviews. Data were analysed using descriptive statistics, Pearson product-moment correlation, hierarchical multiple regression, and one-way ANOVA at $p < 0.05$. Results revealed an exceptionally strong generative safety culture maturity (composite $M = 4.60$ on a 5-point scale), the highest documented in an emerging-economy high-risk environment. Safety communication ($M = 4.65$) and worker empowerment through Stop Work Authority ($M = 4.65$) represented the highest-scoring dimensions. Inferential testing identified a near-perfect correlation ($r = .912$, $p < .001$) between safety culture and employee productivity. Hierarchical regression established that management commitment, transparent communication, and frontline involvement collectively explained 91.8% of the variance in productivity outcomes ($R^2 = .912$, Adjusted $R^2 = .918$, $F = 1118.42$, $p < .001$). Employees overwhelmingly reported that robust safety practices enhance motivation ($M = 4.84$), minimize operational downtime ($M = 4.87$), and drive operational innovation ($M = 4.78$). Significant differences emerged across the sampled operators ($F = 6.842$, $p < .001$), with post-PIA fully indigenous firms outperforming legacy joint-venture operational structures. The study concludes that embedding generative safety culture transforms compliance from a cost burden into a formidable competitive advantage. It recommends formalizing leading safety KPIs in annual appraisals, scaling digital hazard reporting, and establishing an industry peer-benchmarking consortium.

KEYWORDS

Safety culture, Employees' productivity, Oil and gas industry, Stop Work Authority, Management commitment, Safe Systems of Work (SSoW), Rivers State, Petroleum Industry Act (PIA).

Introduction

The oil and gas industry is globally recognized as one of the most technologically intense and hazardous industrial sectors. Exploration, drilling, refining, and pipeline logistics expose personnel to volatile hydrocarbons, extreme pressures, and harsh operational terrains. Consequently, industrial disasters can result in catastrophic loss of life, severe environmental degradation, and paralyzing commercial losses (Gonçalves et al., 2023). In high-reliability sectors, modern risk management emphasizes that safety transcends statutory compliance: it requires an ingrained, organizational safety culture—defined as the shared values, beliefs, attitudes, and behavioural norms that determine how safety is prioritized and enacted across daily operations (Cooper, 2020; Reason, 1997).

In Nigeria, the oil and gas sector remains the lifeblood of national economic solvency, contributing over 80% of foreign export earnings and roughly 65% of fiscal revenues (World Bank, 2024). Rivers State sits at the absolute epicenter of this industry, housing vast hydrocarbon reserves, pivotal refining infrastructure, crude export terminals, and major pipeline networks. However, operational realities in Rivers State are uniquely compounded by systemic security threats, including pipeline sabotage, illegal artisanal refining, community agitations, and extensive asset integrity wear (Anejionu et al., 2023; Reuters, 2025). Historically, high-pressure environments have frequently induced organizations to prioritize short-term production quotas over procedural safety barriers, perpetuating reactive cultures that invite chronic downtime, workforce demoralization, and major process safety incidents (Hopkins, 2019; Okoro & Eze, 2025).

Following the enactment of the Petroleum Industry Act (PIA) of 2021 and an unprecedented wave of International Oil Company (IOC) onshore asset divestments, fully indigenous operators have assumed frontline stewardship over significant upstream blocks. While theoretical frameworks like Hudson's (2007) Safety Culture Maturity Model and Zohar's (1980, 2010) Safety Climate Theory postulate that organizational safety maturity directly predicts efficiency and reliability, empirical investigations verifying this link within indigenous African operators remain exceptionally sparse. Prior Nigerian studies have predominantly examined safety compliance in isolation without quantifying direct linkages to multidimensional employee productivity metrics (Ehiaguina et al., 2024; Nene et al., 2024).

Aim and Objectives: The primary aim of this study was to empirically evaluate the impact of safety culture on employee productivity in selected indigenous oil and gas companies operating in Rivers State. The specific objectives were to: (1) assess the level and maturity of safety culture practiced across selected operators; (2) determine the empirical relationship between safety culture and employee productivity; (3) identify and evaluate the specific safety culture dimensions (management commitment, safety training, communication, and hazard observation/Stop Work Authority) predicting productivity; (4) examine employee perceptions regarding how safety practices impact motivation and efficiency; and (5) compare safety culture maturity levels across the selected oil and gas operators.

2. MATERIAL AND METHODS

2.1 Research Design and Study Area

A cross-sectional correlational design embedded within a convergent mixed-methods framework was adopted. This architecture allowed simultaneous capture of broad quantitative indices across organizational tiers and rich, contextualized qualitative insights from frontline actors (Filho &

Waterson, 2018). The study was situated in Rivers State, Niger Delta region of Nigeria (coordinates approx. 4°45'N to 5°06'N and 6°45'E to 7°05'E). The institutional scope encompassed five prominent upstream and midstream operators: Green Energy International Limited (Company A), Aradel Holdings (Company B), Company C Limited, Allgrace Energy Limited (Company D), and Heirs Energies (Company E). These operators manage flowstations, marginal field processing facilities, and crude delivery networks under the regulatory oversight of the Nigerian Upstream Petroleum Regulatory Commission (NUPRC).

2.2 Population, Sample Size, and Sampling Procedure

The accessible population comprised 2,000 personnel deployed across safety-sensitive technical, engineering, managerial, and administrative functions. Using Yamane's (1967) formula at a 95% confidence level and 5% margin of error, the baseline theoretical sample size was calculated as $n = 2000 / [1 + 2000(0.05)^2] = 333.3$. To compensate for potential unreturned or incomplete instruments, the distribution was expanded to 366 structured questionnaires. A multi-stage sampling technique was utilized, combining purposive selection of active upstream operators with proportionate stratified random sampling across four functional strata (Table 1). A subset of 12 experienced professionals was purposively selected for in-depth semi-structured qualitative interviews.

Table 1: Sampling Framework and Proportional Allocation Across Cadres

Functional Stratum		Target Population (N)	Sampling Technique	Proportion (%)	Allocated Sample (n)
Management Staff		200	Proportionate Random	10.0%	37
Operational Engineering	&	900	Proportionate Random	45.0%	165
Administrative Support		500	Proportionate Random	25.0%	92
HSE Officers Specialists	&	400	Proportionate Random	20.0%	72

2.3 Data Collection Instruments and Psychometric Validation

The quantitative survey utilized a 25-item questionnaire structured along five core dimensions: Management Commitment (B_INDEX), Safety Training (C_INDEX), Safety Communication (D_INDEX), Hazard Observation and Stop Work Authority (E_INDEX), and Perceived Productivity Impact (F_INDEX). All latent constructs were measured on a 5-point Likert scale (1 = Never to 5 = Always). The instrument underwent rigorous content and construct validation by an expert panel of university ergonomists and oilfield safety directors. Pilot testing (n = 30) yielded excellent internal consistency, with Cronbach's alpha coefficients exceeding 0.70 across all subscales (0.781 to 0.884).

2.4 Analytical Approach

Statistical computations were executed using IBM SPSS Statistics Version 27. Descriptive statistics (means, standard deviations, percentage distributions) established baseline trends. Pearson Product-Moment Correlation evaluated bivariate associations. Hierarchical Multiple Regression Analysis tested the sequential predictive power of safety dimensions on productivity, adhering to the regression specification: $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$. One-Way ANOVA with post-hoc Tukey HSD examined differences across operators at $p < 0.05$. Qualitative interview recordings were transcribed verbatim and evaluated through six-phase thematic analysis using NVivo Version 14.

3. RESULTS AND DISCUSSIONS

3.1 Demographic Characteristics of Respondents

From 366 questionnaires distributed, 333 were fully retrieved and validated, reflecting an effective response rate of 90.98%. Demographic breakdown (Table 2) showed that males constituted 72.37% ($n = 241$) and females 27.63% ($n = 92$). While aligning with the historically male-dominated nature of heavy oilfield operations, the 27.63% female representation exceeds historical national baselines (19–22%), reflecting progressive inclusion within technical, HSE, and administrative functions under post-PIA local content frameworks (Okoro & Eze, 2025). The cohort was predominantly prime working-age (57.66% aged 31–45 years; 32.13% over 45 years), and highly experienced, with 43.24% reporting over 10 years of service and 41.74% having 5–10 years. Frontline operational and engineering personnel represented nearly half the cohort (49.85%), ensuring that assessments directly reflect sharp-end field realities.

Table 2: Demographic Profile of Survey Respondents (N = 333)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	241	72.37%
	Female	92	27.63%
Age Bracket	18–30 years	34	10.21%
	31–45 years	192	57.66%
	Over 45 years	107	32.13%
Job Classification	Operational / Engineering	166	49.85%
	Administrative Support	80	24.02%
	HSE Specialist / Officer	61	18.32%
	Management Staff	26	7.81%
Industry Experience	Less than 5 years	50	15.02%
	5–10 years	139	41.74%
	Over 10 years	144	43.24%
Company Distribution	Company A / Company D	71 each	21.32% each
	Company E / B / C	72 / 63 / 56	21.62% / 18.92% / 16.82%

3.2 Descriptive Assessment of Safety Culture Maturity

Evaluation of dimensional indices demonstrated exceptionally high safety culture maturity across the selected indigenous operators (Table 3). Safety Communication (D_INDEX) and Hazard Observation / Stop Work Authority (E_INDEX) tied for the highest composite mean ($M = 4.65$). Within communication, daily toolbox talks recorded an unprecedented mean of 4.87 ($SD = 0.44$), followed by open hazard reporting channels ($M = 4.81$, $SD = 0.55$). For hazard observation and SWA, encouragement to report unsafe conditions scored 4.83, while organizational support for SWA reached 4.72. Perceived Impact on Productivity (F_INDEX) achieved a composite mean of 4.74 ($SD = 0.44$), driven by items confirming that safety reduces downtime ($M = 4.87$) and enhances motivation ($M = 4.84$). Applying Hudson's (2007) maturity ladder, the overall weighted composite index of 4.60 firmly positions these operators in the 'Generative' stage—a level where safety is completely embedded in operational excellence.

Table 3: Summary of Safety Culture Dimension Indices and Perceived Productivity

Construct / Dimension	Survey Items	Mean	Std. Dev.	Maturity Classification
Management Commitment (B)	5 items (B1–B5)	4.36	0.781	Proactive to Generative
Safety Training Systems (C)	5 items (C1–C5)	4.40	0.784	Proactive
Safety Communication (D)	5 items (D1–D5)	4.65	0.547	Generative
Hazard Obs. & SWA (E)	5 items (E1–E5)	4.65	0.606	Generative
Productivity Impact (F)	5 items (F1–F5)	4.74	0.443	Exceptional Synergy
Overall Weighted Index	All 25 items	4.60	0.528	Fully Generative (Top Stage)

3.3 Inferential Statistics and Hypothesis Testing

Test of Hypothesis 1 (H_{01}): Bivariate Pearson correlation between overall safety culture and perceived productivity yielded $r = .912$ ($p < .001$). This near-perfect positive correlation accounts for 83.1% shared variance ($r^2 = 0.831$), leading to a decisive rejection of H_{01} . This finding empirically refutes traditional notions that safety compliance impedes productivity.

Test of Hypothesis 2 (H_{02}): Hierarchical multiple regression analysis (Table 4) evaluated the progressive predictive capability of core safety culture dimensions on employee productivity. In Step 1, Management Commitment alone accounted for 68.9% of productivity variance ($\beta = .831$, $p < .001$). In Step 2, adding Safety Communication introduced a 15.6% variance increment ($\Delta R^2 = .156$, $\beta = .412$, $p < .001$), elevating cumulative R^2 to .845. In Step 3, frontline employee empowerment (Hazard Observation and SWA) contributed an additional 6.7% variance ($\Delta R^2 = .067$, $\beta = .347$, $p < .001$). The final regression model accounted for 91.8% of variance in employee productivity (Adjusted $R^2 = .918$, $F(3, 329) = 1118.42$, $p < .001$), soundly rejecting H_{02} .

Table 4: Hierarchical Multiple Regression Model for Predicting Employee Productivity

Step	Predictor Dimension Entered	Std. Beta (β)	ΔR^2	Cumulative R^2	p-value
Step 1	Management Commitment (B)	.831	.689	.689	$p < .001^*$
Step 2	+ Safety Communication (D)	.412	.156	.845	$p < .001^*$
Step 3	+ Hazard Obs. & SWA Empowerment (E)	.347	.067	.912	$p < .001^*$

Test of Hypothesis 3 (H_{03}): Pearson correlation coefficients between specific safety perceptions and individual productivity indicators ranged between $r = .874$ and $r = .912$ (Table 5). The association between strong safety culture and motivation reached $r = .912$ ($p < .001$), while downtime reduction achieved $r = .901$ ($p < .001$). The composite perceptual index (F_INDEX) correlated with overall productivity at $r = .935$ ($p < .001$), decisively rejecting H_{03} .

Table 5: Correlations Between Safety Perceptions, Worker Motivation, and Productivity Indicators

Perceptual Item (F_INDEX Construct)	Pearson r	Shared (r^2)	Variance	Significance (p)
Strong safety culture enhances my motivation to perform	.912	83.1%		$p < .001^*$
Adhering to safety practices reduces downtime & improves efficiency	.901	81.2%		$p < .001^*$
Positive safety culture increases job satisfaction & retention	.889	79.0%		$p < .001^*$
Safety practices encourage innovative operational ideas	.874	76.4%		$p < .001^*$
I feel that safety concerns are taken seriously by management	.881	77.6%		$p < .001^*$
Overall Composite F_INDEX $\times$ Overall Productivity Perception	.935	87.4%		$p < .001^*$

Test of Hypothesis 4 (H_{04}): One-way ANOVA comparing overall safety culture across the five companies revealed statistically significant inter-firm divergence ($F(4, 328) = 6.842$, $p < .001$, Table 6), rejecting H_{04} . Post-hoc Tukey HSD testing identified that fully indigenous operators established post-PIA (Company D, $M = 4.71$; Company A, $M = 4.69$; Company E, $M = 4.65$) scored significantly higher than operators maintaining legacy joint-venture structures (Company B, $M = 4.52$, $p < .05$; Company C, $M = 4.40$, $p < .01$).

Table 6: One-Way Analysis of Variance (ANOVA) Across Participating Oil and Gas Operators

Operator / Source	Sample (n)	Mean (M)	Std. Dev. (SD)	F-Statistic	p-value
Allgrace Energy (Company D)	71	4.712	0.412		
Green Energy Int. (Company A)	71	4.689	0.398		
Heirs Energies (Company E)	72	4.651	0.456	6.842	p < .001*
Aradel Holdings (Company B)	63	4.523	0.512		
Company C Limited	56	4.398	0.618		
Total Cohort	333	4.604	0.528		

3.4 Thematic Discussion

The empirical findings demonstrate that indigenous operators in Rivers State have transitioned into a generative safety culture maturity stage. Historically characterized as calculative or reactive (Ehiaguina et al., 2024), these firms have leveraged local ownership, post-PIA regulatory compliance, and flatter hierarchies to foster psychological safety. Qualitative interviews corroborated this transformation: supervisors noted that Stop Work Authority is no longer feared as an act of insubordination, but embraced as an essential barrier against catastrophic asset loss. Furthermore, the 91.8% explained variance in productivity validates Social Exchange Theory and High Reliability Organization (HRO) principles: when leadership actively prioritizes life preservation and transparent communication, employees reciprocate with heightened vigilance, minimal procedural shortcuts, reduced machine downtime, and greater innovation.

4. CONCLUSIONS AND RECOMMENDATIONS

This study conclusively demonstrates that generative safety culture is not an operational impediment, but the paramount catalyst of employee productivity in hazardous environments. Within Nigeria's evolving upstream landscape, visible leadership commitment, daily toolbox communication, and unencumbered Stop Work Authority collectively drive operational efficiency and workforce motivation.

Practical Recommendations for Industry and Regulators

1. Institutionalization of Leading Safety KPIs: Shift regulatory audits from lagging incident metrics (TRIR, LTI) to leading indicators, mandating that operators evaluate management field engagement, SWA application, and toolbox quality.
2. Digitalization of Hazard Reporting: Transition from paper observation cards to mobile and cloud-based hazard reporting dashboards to reduce feedback cycle times and maintain workforce engagement.
3. Non-Monetary Safety Recognition: Rectify the identified reward gap ($M = 3.92$) through structured peer-recognition schemes, public commendations, and integrating safety leadership into promotions.

4. Upstream Safety Benchmarking Consortium: Establish a Niger Delta safety consortium under NUPRC guidance to share operational hazard data and accelerate transition of calculative firms to generative maturity.

ACKNOWLEDGEMENTS

The authors express sincere gratitude to the Centre for Occupational Health, Safety and Environment (COHSE), Faculty of Engineering, University of Port Harcourt, for institutional, analytical, and academic support. Heartfelt appreciation is extended to the management and operational personnel of Green Energy International Limited, Aradel Holdings, Company C Limited, Allgrace Energy Limited, and Heirs Energies for facilitating primary data collection.

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