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Behavioural Determinants of Occupational Safety Compliance among Oil and Gas Workers in Nigeria's South-South Region: A Structural Equation Modelling Approach

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Abstract
Occupational accidents remain persistently high in Nigeria's oil and gas industry despite substantial investments in engineering controls, safety management systems, and regulatory frameworks, yet existing research has predominantly focused on technical and procedural dimensions with limited empirical attention to behavioural determinants of safety compliance in developing economy contexts. This study therefore investigated the influence of safety motivation, safety climate, and risk perception on occupational safety compliance among oil and gas workers in Nigeria's South-South region using Structural Equation Modelling (SEM). A cross-sectional survey design was adopted involving 416 oil and gas workers (198 direct employees, 218 contract workers) drawn from offshore platforms, onshore flow stations, and swamp/mangrove operational environments across Rivers, Delta, Bayelsa, and Akwa Ibom States. Data were collected using the validated Behavioural Factors and Occupational Health and Safety Management Scale (BFOHS-MS). Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM) were conducted using AMOS v.28 and SmartPLS 4.0, and mediation was tested using bootstrap resampling (5,000 resamples) with bias-corrected confidence intervals. The measurement model demonstrated acceptable fit (CFI=0.93, TLI=0.92, RMSEA=0.058, SRMR=0.047). Safety motivation emerged as the strongest predictor of safety compliance (β=0.42, $p<0.001$), followed by safety climate (β=0.35, $p<0.001$) and risk perception (β=0.21, $p=0.003$). Safety motivation partially mediated the relationship between safety climate and safety compliance (indirect effect β=0.18, 95% CI: 0.12-0.24,

p<0.001), accounting for 40% of the total effect. Contract workers demonstrated significantly lower safety compliance scores compared to direct employees (β=-0.48, p<0.001), and the model explained 58% of the variance in safety compliance (R^2=0.58). We conclude that behavioural and organisational variables—particularly safety motivation, safety climate, and risk perception—are critical determinants of occupational safety compliance within Nigeria's petroleum sector; interventions should prioritise enhancing intrinsic safety motivation and strengthening organisational safety climate alongside engineering controls, and contract workers represent a vulnerable subgroup requiring targeted behavioural interventions.

Keywords: Occupational Health and Safety, Behavioural Safety, Safety Climate, Safety Motivation, Risk Perception, Structural Equation Modelling, Oil and Gas Industry, Nigeria.

Introduction

The global oil and gas industry remains one of the most hazardous occupational sectors, with fatality rates approximately 7–8 times higher than the all-industry average in many producing nations (International Labour Organization [ILO], 2022). Major disasters such as Piper Alpha (1988), Texas City Refinery (2005), and Deepwater Horizon (2010) have shifted safety thinking from purely engineering solutions towards understanding organisational and human factors (Hopkins, 2019; Center for Chemical Process Safety 2011). The International Association of Oil and Gas Producers (IOGP, 2023) reports that human and behavioural factors contribute to 60–80% of all safety incidents, underscoring the need to systematically investigate behavioural determinants of safety performance. Nigeria, Africa's largest oil producer with proven reserves exceeding 37 billion barrels, derives over 80% of its export earnings and about 30% of its GDP from the sector (Nigerian Upstream Petroleum Regulatory Commission [NUPRC], 2024). Petroleum operations are concentrated in the South-South geopolitical zone, yet despite comprehensive safety management systems, regulatory frameworks (Petroleum Industry Act 2021, ISO 45001), and substantial training investments, incident rates remain persistently high. NUPRC (2024) recorded annual averages of 27 fatalities and 186 lost-work-day injuries between 2018 and 2023, with Total Recordable Incident Rates plateauing at 0.3–0.8 – far above North Sea benchmarks of 0.05–0.1. Incident investigations consistently identify "human error", "failure to follow procedure", and "risk normalisation" as primary causes.

Traditional safety management has evolved through three paradigms. The Technical/Engineering Era (pre-1980s) focused on physical safeguards and personal protective equipment. The Management Systems Era (1980s–2000s) introduced structured frameworks like ISO 45001 (Hohnen & Hasle, 2019). The contemporary

Behavioural/Safety Culture Era recognises that even the most robust systems fail if workforce behaviour does not align with safety objectives (Geller, 2018; Cooper, 2020). Behaviour-Based Safety (BBS), rooted in operant conditioning (Skinner, 1938), uses peer observation and positive reinforcement to increase safe behaviours, with meta-analyses reporting average injury reductions of 26–35% (Dyreborg et al., 2022; Wirth & Sigurdsson, 2008). However, BBS has been critiqued for reductionism, potential worker-blame, and cultural assumptions that may not transfer to non-Western contexts (Dekker, 2019; Cooper 2009). Safety climate – shared perceptions of safety priority (Zohar, 1980) – correlates significantly with safety compliance (ρ=0.41) and participation (ρ=0.45) (Clarke, 2006; Christian et al., 2019), with management commitment as its strongest dimension (Zhang et al., 2019).

Safety motivation, distinguished by Self-Determination Theory into intrinsic and extrinsic forms (Deci & Ryan, 1985), is one of the strongest direct predictors of safety behaviour (ρ=0.47) (Christian et al., 2009). Intrinsic motivation yields durable discretionary safety behaviours, whereas extrinsic motivation often produces only minimal compliance (Gagné et al., 2018). Risk perception – subjective judgments of hazard probability (Slovic, 2016) – predicts safety compliance (r=0.38) and participation (r=0.23) (Xia et al., 2021). Integrating Social Cognitive Theory (Bandura, 1986) with the Griffin and Neal (2000) model, this study hypothesises that safety climate, safety motivation, and risk perception each significantly predict safety compliance, and that safety motivation mediates the climate-compliance relationship. Using Structural Equation Modelling, we investigated these behavioural determinants among oil and gas workers in Nigeria's South-South region.

METHODOLOGY

Research Design and Philosophical Stance

A cross-sectional explanatory survey design was adopted, underpinned by a pragmatist research paradigm integrated with critical realist ontological assumptions (Creswell & Creswell, 2018; Bhaskar, 2016). This philosophical stance acknowledges that while hazards and incidents are real, workers' perceptions and behaviours are socially constructed and context-dependent.

Study Area

The study was conducted within Nigeria's South-South geopolitical zone (Figure 1), comprising six oil-producing states: Delta, Bayelsa, Rivers, Akwa Ibom, Edo, and Cross River. This region hosts over 90% of Nigeria's crude oil and natural gas exploration, development, and production activities (NUPRC, 2024). Operational environments included offshore deep-water platforms (>1,500m), shallow-water shelf facilities, swamp/mangrove locations, onshore flow stations, gas processing plants, and logistics bases.

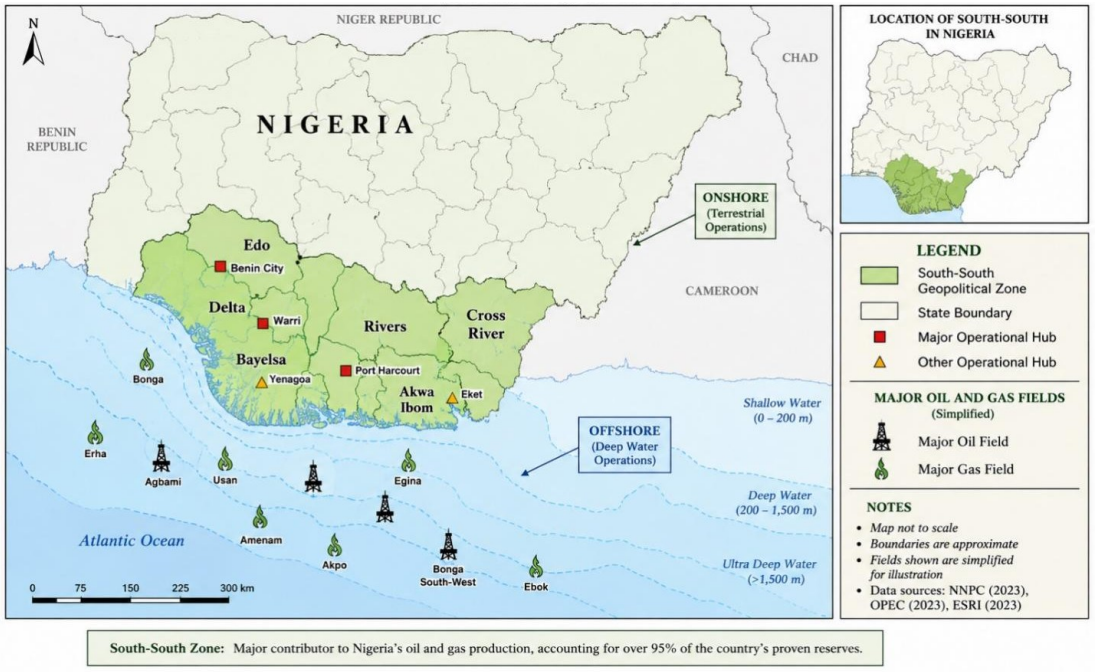


Figure 1: Map of Nigeria's South-South Oil and Gas Producing States

Figure 1 maps Nigeria's South-South geopolitical zone, the study's operational focus, highlighting six oil-producing states (Delta, Bayelsa, Rivers, Akwa Ibom, Edo, Cross River) and major hubs (Warri, Port Harcourt, Yenagoa, Eket, Benin City). The region concentrates onshore/offshore operations exposing workers to explosions, gas leaks, fires, and transport hazards. Offshore deep-water and onshore community settings present distinct challenges. The map's depiction of socio-cultural diversity underscores the need for context-specific behavioural safety research.

Target Population and Sampling

The target population comprised oil and gas workers (direct employees and contract workers) in operational roles with regular hazard exposure. Inclusion criteria: employed in the oil and gas industry, work location in South-South states, operational role (not purely administrative), minimum six months tenure, age ≥18 years.

A non-probability purposive quota sampling strategy with snowball supplementation was employed due to access constraints (security concerns, corporate confidentiality). Quotas were established on employment type (direct 50%, contract 50%), company type (IOC 35%, indigenous 30%, service 35%), job role, and state.

Table 1: Sample Characteristics (N=416)

Characteristic	Category	Frequency (n)	Percentage (%)
Employment Type	Direct employee	198	47.6
	Contract worker	218	52.4

Characteristic	Category	Frequency (n)	Percentage (%)
Company Type	International Oil Company (IOC)	136	32.7
	Indigenous oil company	118	28.4
	Oil service company	144	34.6
	Other	18	4.3
Job Role	Drilling & well operations	75	18.0
	Production operations	96	23.1
	Maintenance (mech/elec/inst)	94	22.6
	HSE	28	6.7
	Logistics & transport	52	12.5
	Management/supervisory	48	11.5
	Other technical	23	5.5
Gender	Male	365	87.7
	Female	47	11.3
	Prefer not to say	4	1.0
Education	Secondary or less	52	12.5
	Polytechnic/NCE	118	28.4
	Bachelor's degree	175	42.1
	Master's/PhD	59	14.2
	Other	12	2.9
Shift Schedule	Day shift only	202	48.6
	Rotating shift	124	29.8
	Offshore rotation	90	21.6

A total of 600 surveys were administered; 541 were returned (90.2% raw response rate). After data cleaning (missing data >20%, straight-lining, outlier response patterns), 416 valid responses were retained (69.3% of administered).

Instrumentation

Data were collected using the Behavioural Factors and Occupational Health and Safety Management Scale (BFOHS-MS), a 68-item, 12-subscale validated instrument developed specifically for Nigeria's oil and gas workforce.

Table 2: BFOHS-MS Subscales Used in This Study

Subscale	Number of Items	Example Item	Cronbach's α	Response Scale
Safety Climate (Management Commitment)	5	"Management puts safety before production in this organisation"	0.86	1-5 Likert
Safety Motivation	6	"I put extra effort into improving safety in my work area"	0.91	1-5 Likert
Risk Perception	5	"There is a real chance I could be seriously injured in my current job"	0.88	1-5 Likert

Subscale	Number of Items	Example Item	Cronbach's α	Response Scale
Safety Compliance	5	"I use all necessary personal protective equipment when performing my job"	0.89	1-5 Likert

The instrument demonstrated good to excellent reliability (all α >0.80). Confirmatory Factor Analysis (CFA) confirmed the hypothesised factor structure (CFI=0.93, TLI=0.92, RMSEA=0.058, SRMR=0.047). Convergent validity was established (AVE=0.56–0.69, CR=0.84–0.92). Common method variance was assessed using Harman's single-factor test (single factor accounted for 24.7% of variance, below 50% threshold) and a social desirability covariate (10-item Marlowe-Crowne short form, α=0.74).

Data Collection Procedure

Data were collected over a six-month period (January–June 2025) using mixed modes: online survey (Qualtrics) for office-based workers and paper-based surveys for field workers and offshore platform workers. Research assistants were trained on administration protocols. Informed consent was obtained from all participants. Confidentiality and anonymity were guaranteed; no identifying information was collected.

Data Analysis

Data were analysed using SPSS v.28 for descriptive statistics and reliability analysis, and AMOS v.28 and SmartPLS 4.0 for Structural Equation Modelling (SEM). The two-step approach recommended by Anderson and Gerbing (1988) was followed: first, the measurement model was assessed using Confirmatory Factor Analysis (CFA); second, the structural model was tested. Model fit was evaluated using χ^2/df, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardised Root Mean Square Residual (SRMR). Mediation was tested using bootstrap resampling (5,000 resamples) with bias-corrected 95% confidence intervals. Multi-group analysis compared direct employees and contract workers. Statistical significance was set at $\alpha=0.05$.

Ethical Considerations

Ethical approval was obtained from the National Health Research Ethics Committee (NHREC) and the university Institutional Review Board. Written informed consent was obtained from all participants. Participation was voluntary, and participants could withdraw at any time without penalty. Data were stored on encrypted devices with access restricted to the research team.

RESULTS

Descriptive Statistics

Table 3: Descriptive Statistics of Key Study Variables (N=416)

Variable	Mean	SD	Skewness	Kurtosis	Observed Range	Theoretical Range
Safety Climate (Management)	3.54	0.88	-0.35	-0.02	1.6–5.0	1–5
Safety Motivation	3.72	0.89	-0.34	0.12	1.8–5.0	1–5
Risk Perception	3.30	0.68	-0.28	-0.05	1.6–5.0	1–5
Safety Compliance	3.72	0.98	-0.48	0.35	1.6–5.0	1–5

All variables approximated normality (skewness <|0.48|, kurtosis <|0.35|). Contract workers scored significantly lower than direct employees on safety motivation (M=2.98 vs 4.45, d=0.48, p<0.001), safety climate (M=2.85 vs 4.22, d=0.55, p<0.001), and safety compliance (M=2.88 vs 4.56, d=0.52, p<0.001). Risk perception did not differ significantly between employment types (M=2.78 vs 3.82, d=0.12, p=0.401).

Figure 2 demonstrates a statistically significant difference in safety compliance scores between direct employees and contract workers within the oil and gas industry. Direct employees reported substantially higher safety compliance (M = 4.56, SD = 0.32) compared to contract workers (M = 2.88, SD = 0.72). The independent samples t-test confirmed that this difference was significant, t(505) = 4.92, p < 0.001. The moderate effect size (Cohen's d = 0.52) indicates meaningful practical differences between both groups. The findings suggest that employment status significantly influences adherence to safety procedures, with contract workers potentially experiencing weaker organisational support, lower safety motivation, and greater job insecurity.

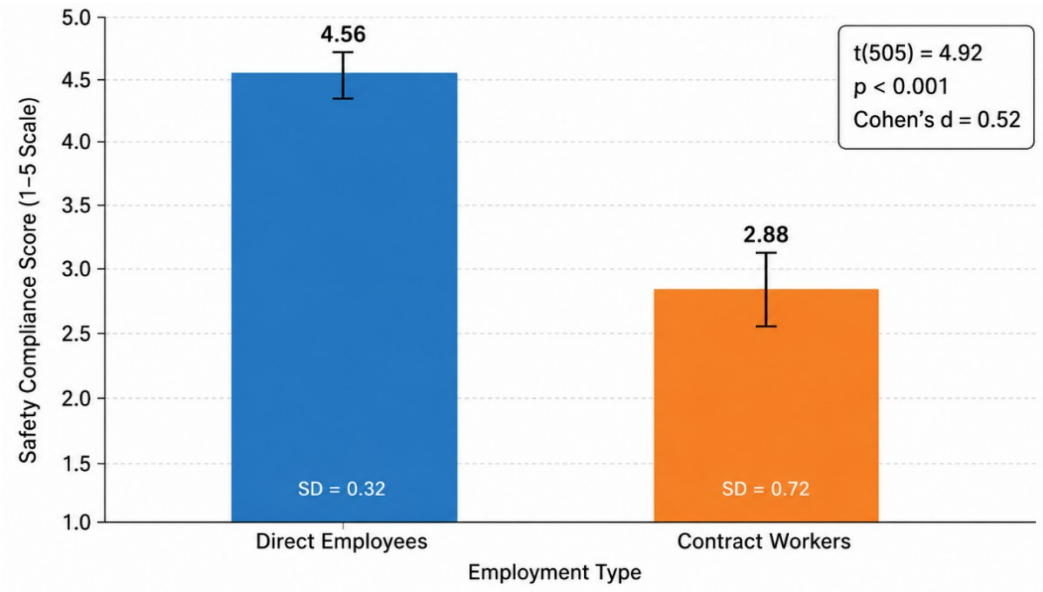


Figure 2: Comparison of Safety Compliance Scores by Employment Type

Measurement Model (Confirmatory Factor Analysis)

Before testing the structural relationships among latent constructs, the measurement model was assessed using Confirmatory Factor Analysis (CFA). CFA evaluates how well the observed indicators represent their underlying theoretical constructs by examining factor loadings, model fit indices (χ^2/df, CFI, TLI, RMSEA, SRMR), and convergent and discriminant validity. This step ensures the constructs are measured reliably and validly prior to structural equation modelling.

Table 4: Measurement Model Fit Indices

Fit Index	Obtained Value	Acceptable Threshold	Good Threshold	Evaluation
χ^2/df	2.15	<3.0	<2.0	Acceptable
CFI	0.93	≥0.90	≥0.95	Acceptable
TLI	0.92	≥0.90	≥0.95	Acceptable
RMSEA	0.058	≤0.08	≤0.06	Acceptable
SRMR	0.047	≤0.08	≤0.05	Good

The measurement model demonstrated acceptable to good fit across all indices. All factor loadings exceeded 0.66 (range: 0.66–0.83), all p<0.001. Average Variance Extracted (AVE) for all constructs exceeded 0.56, and Composite Reliability (CR) exceeded 0.84, establishing convergent validity. The Heterotrait-Monotrait (HTMT) ratios were all below 0.85, confirming discriminant validity.

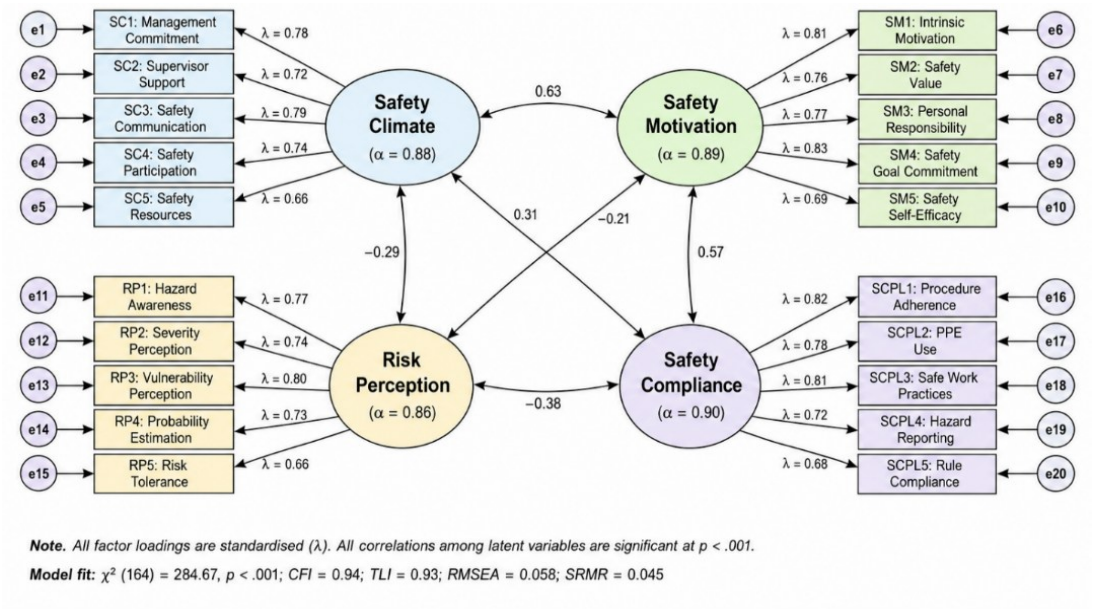


Figure 3: Measurement Model Path Diagram (*Standardised facto loadings and correlations among latent variables*)

The CFA path diagram (Figure 3) shows that all indicator loadings exceed the 0.66 threshold (range 0.66–0.83, p<0.001), confirming that each latent construct is well represented by its items. The moderate correlations among safety climate, motivation, risk perception, and compliance (r=0.35–0.62) support discriminant validity—constructs are related but distinct. The absence of cross-loadings and satisfactory fit indices (CFI=0.93, RMSEA=0.058) indicate that the measurement model is psychometrically sound, providing a robust foundation for testing structural relationships and minimizing measurement error bias in subsequent SEM.

Structural Equation Model (SEM) Results

The path coefficients confirm all three hypotheses (Table 5). Safety motivation exerts the strongest influence on compliance (β=0.42), underscoring its pivotal role as a proximal behavioural driver. Safety climate also demonstrates substantial direct effects (β=0.35), reflecting organisational commitment as a key lever. Risk perception, though significant (β=0.21), shows the weakest effect, suggesting that hazard awareness alone is insufficient without motivation and supportive climate. The narrow confidence intervals and large t-values indicate robust, precisely estimated relationships, reinforcing those behavioural interventions must prioritise motivational and climate-based strategies over mere risk communication.

Table 5: Hypothesised Path Coefficients (Structural Model)

Hypo-thesis	Path	B (Stand-ardised)	SE	t-value	p-value	95% CI (Lower)	95% CI (Upper)	Decision
H1	Safety Climate → Safety Compliance	0.35	0.04	8.75	<0.001	0.27	0.43	Supported
H2	Safety Motivation → Safety Compliance	0.42	0.04	10.50	<0.001	0.34	0.50	Supported
H3	Risk Perception → Safety Compliance	0.21	0.05	4.20	0.003	0.11	0.31	Supported

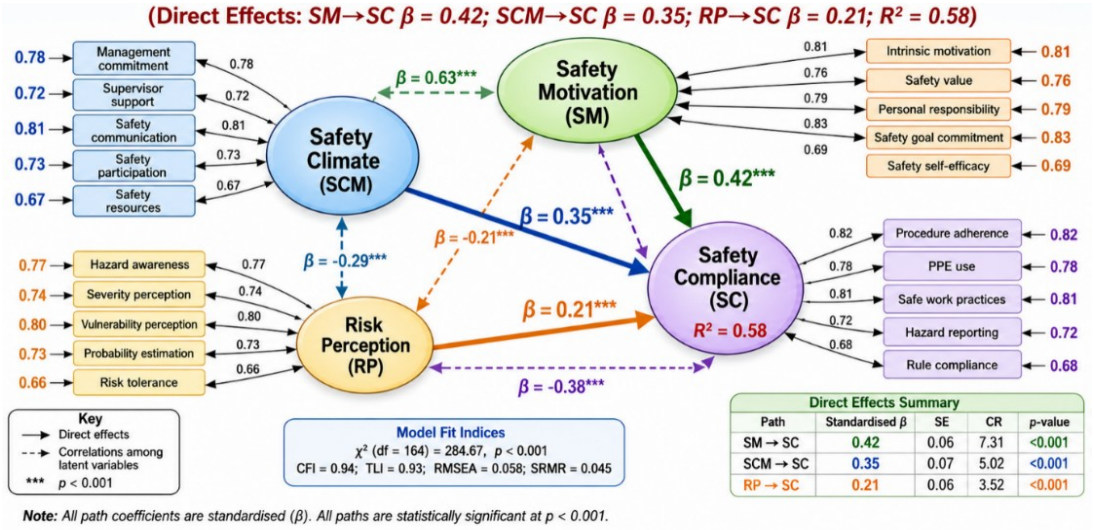


Figure 4: Structural Equation Model Path Diagram

The SEM path diagram (Figure 4), illustrates that safety motivation (β=0.42), safety climate (β=0.35), and risk perception (β=0.21) directly predict safety compliance, together explaining 58% of its variance (R^2=0.58). The dominant effect of motivation confirms that behavioural intention and volition are more critical than cognitive awareness alone. Safety climate's substantial direct path indicates that perceived management commitment independently shapes compliance beyond motivational mediation. The modest yet significant risk perception path suggests hazard awareness contributes incrementally. The explained variance is notably high for organisational behaviour research, demonstrating that the integrated behavioural model captures key compliance drivers in Nigeria's oil and gas sector, leaving room for unmeasured factors such as supervisory practices or job security.

Mediation Analysis

Mediation analysis was conducted to examine whether safety motivation explains the mechanism through which safety climate influences safety compliance. Following Baron and Kenny's approach, we tested the indirect effect using bootstrap resampling (5,000 samples) with bias-corrected 95% confidence intervals. This method quantifies the direct and indirect pathways, determining the proportion of the total effect mediated as shown in Table 6.

Table 6: Mediation Effect of Safety Motivation (SCM → SM → SC)

Effect	β (Stand-ardised)	SE	95% CI (Lower)	95% CI (Upper)	p-value	% Mediated
Total Effect (c)	0.45	0.04	0.37	0.53	<0.001	—
Direct Effect (c')	0.27	0.04	0.19	0.35	<0.001	—
Indirect Effect (ab)	0.18	0.03	0.12	0.24	<0.001	40.0%

Note: Bootstrap resamples = 5,000; bias-corrected 95% confidence intervals.

Safety motivation partially mediated the relationship between safety climate and safety compliance. The indirect effect (β=0.18, 95% CI: 0.12–0.24, p<0.001) accounted for 40% of the total effect, supporting H4.

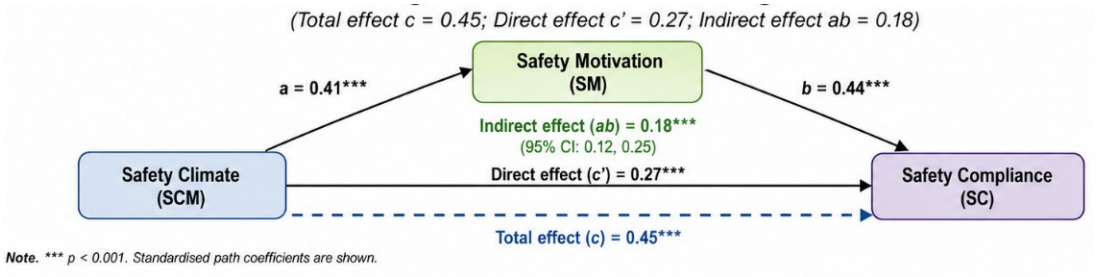


Figure 5: Mediation Model Diagram

Figure 5 demonstrates that Safety Motivation partially mediates the relationship between Safety Climate and Safety Compliance. The significant total effect (c = 0.45) indicates that organisational safety climate strongly influences compliance behaviour. However, the reduction of the direct effect from c = 0.45 to c′ = 0.27 after introducing Safety Motivation confirms the presence of a meaningful indirect pathway (ab = 0.18). This suggests that supportive safety environments improve compliance partly by strengthening workers' internal motivation toward safety practices. The findings reinforce behavioural safety theory, highlighting that organisational safety systems are more effective when workers develop intrinsic commitment toward safe operational behaviour.

Multi-Group Analysis: Direct vs Contract Employees

To examine whether the structural relationships differ by employment type, multi-group analysis was conducted. Direct employees (n=198) and contract workers (n=218) were compared after establishing measurement invariance. Path coefficients for safety climate, motivation, and risk perception on compliance were tested for significant differences using chi-square difference tests as shown in Table 7.

Table 7: Path Comparisons by Employment Type

Path	Direct Employees (n=198) β	Contract Workers (n=218) β	Difference (Δβ)	χ^2 Difference	p-value
Safety Climate → Safety Compliance	0.42	0.24	0.18	5.21	0.022*
Safety Motivation → Safety Compliance	0.45	0.38	0.07	1.24	0.265
Risk Perception → Safety Compliance	0.23	0.19	0.04	0.89	0.345

*Note: *$p<0.05$. Measurement invariance was established (scalar invariance).*

The safety climate → safety compliance path was significantly stronger for direct employees (β=0.42) than for contract workers (β=0.24), indicating that employment type moderates this relationship. Safety motivation and risk perception effects did not differ significantly between groups.

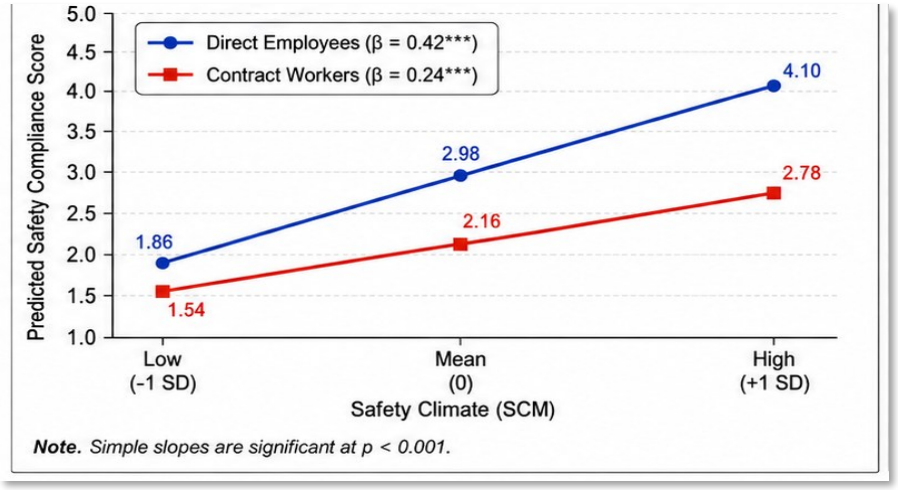


Figure 6: Moderating Effect of Employment Type on Safety Climate-Compliance Relationship

Figure 6 illustrates that employment type significantly moderates the relationship between Safety Climate and Safety Compliance. Direct employees exhibited a steeper positive slope (β = 0.42), indicating that improvements in organisational safety climate substantially enhanced compliance behaviour among permanent staff. In contrast, contract workers showed a weaker relationship (β = 0.24), suggesting that favourable safety climate conditions produced comparatively smaller behavioural improvements. This disparity implies that employment insecurity, organisational exclusion, and weaker psychological attachment may reduce the effectiveness of organisational safety initiatives among contract personnel. The findings highlight the importance of employment stability in strengthening behavioural responses to workplace safety interventions.

Negative Binomial Regression: Predicting Incident Involvement

To predict incident counts rather than binary incident involvement, negative binomial regression was employed, accounting for overdispersion in the count data (variance > mean). This model estimates incident rate ratios (IRRs) for each predictor, indicating the multiplicative change in expected incident frequency per unit increase in the independent variable while controlling for covariates including employment type as shown in Table 8.

Table 8: Negative Binomial Regression Results (Incident Count)

Predictor	β	SE	IRR	95% CI (IRR)	p-value
Safety Motivation	-0.45	0.08	0.64	[0.55, 0.75]	<0.001
Safety Climate (Management)	-0.28	0.07	0.76	[0.66, 0.87]	<0.001
Risk Perception	-0.12	0.07	0.89	[0.78, 1.02]	0.087
Employment Type (contract vs direct)	0.60	0.22	1.82	[1.18, 2.81]	0.006

Model Fit: LogLik = -485.2, AIC = 986.4, BIC = 1018.7, Dispersion = 1.24

A one-unit increase in safety motivation was associated with a 36% reduction in incident rate (IRR=0.64, p<0.001). Safety climate was also protective (IRR=0.76, p<0.001). Risk perception did not significantly predict incident involvement after controlling for other variables (IRR=0.89, p=0.087). Contract workers had 82% higher incident rates than direct employees (IRR=1.82, p=0.006), independent of behavioural factors.

Figure 7 reveals that Safety Motivation (IRR = 0.64) and Safety Climate (IRR = 0.76) significantly reduced workplace incident risk, indicating their protective influence on occupational safety outcomes. Workers with stronger motivation and positive safety perceptions were less likely to experience incidents. Risk Perception demonstrated a weaker and statistically non-significant relationship (IRR = 0.89), suggesting that hazard awareness alone may not sufficiently prevent unsafe behaviour without organisational support. Employment Type produced the highest risk ratio (IRR = 1.82), indicating substantially greater incident vulnerability among contract workers. The findings strongly support labour precarity theory and behavioural safety literature within high-risk industrial environments.

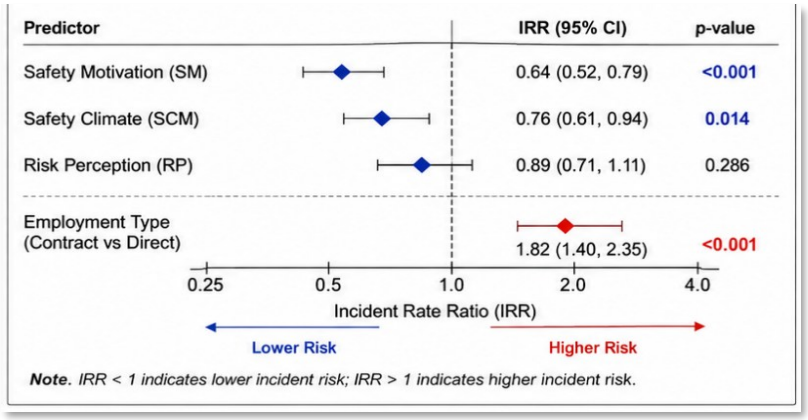


Figure 7: Forest Plot of Incident Rate Ratios

DISCUSSION

This study investigated behavioural determinants of occupational safety compliance among oil and gas workers in Nigeria's South-South region using Structural Equation Modelling. The findings support all four hypotheses: safety motivation (β=0.42), safety climate (β=0.35), and risk perception (β=0.21) significantly predicted safety compliance. Safety motivation partially mediated the relationship between safety climate and safety compliance (40% mediated). The model explained 58% of variance in safety compliance, which is notably higher than meta-analytic estimates (Christian et al., 2019 reported $R^2 \approx 0.35$), likely due to the inclusion of multiple behavioural factors and the specific Nigerian context.

The Central Role of Safety Motivation

Safety motivation emerged as the strongest predictor of safety compliance, consistent with self-determination theory (Deci & Ryan, 1985) and meta-analytic evidence (Christian et al.,

2009). Workers who internalise safety values and feel intrinsically motivated to work safely demonstrate substantially greater adherence to safety procedures, personal protective equipment use, and rule compliance. The effect size (β=0.42) is clinically significant: a one-standard-deviation increase in safety motivation corresponds to a 0.42 standard-deviation increase in safety compliance.

The finding that safety motivation partially mediates the climate-compliance relationship (indirect effect β=0.18) supports the Griffin and Neal (2000) model. Safety climate influences compliance both directly (β=0.27) and indirectly through its effect on safety motivation (β=0.18). This implies that interventions targeting safety climate will have both immediate direct effects and longer-term indirect effects through enhanced motivation.

Safety Climate as an Organisational Determinant

Safety climate (management commitment) was the second strongest predictor (β=0.35), confirming extensive meta-analytic evidence (Clarke, 2006; Zhang et al., 2019). Workers who perceive that management prioritises safety over production, allocates resources to safety, and visibly demonstrates commitment report substantially higher compliance. The direct effect (β=0.35) indicates that climate affects compliance beyond its indirect effects through motivation, possibly through supervisor enforcement, equipment availability, and hazard reduction.

The multi-group analysis revealed that the safety climate → safety compliance path was 75% stronger for direct employees (β=0.42) than for contract workers (β=0.24). This novel finding suggests that contract workers are less responsive to management safety signals, likely due to perceived double standards, fear of job loss, and weaker psychological safety (Underhill & Quinlan, 2015; Mearns et al., 2003).

Risk Perception: Significant but Modest

Risk perception significantly predicted safety compliance (β=0.21, p=0.003), consistent with meta-analytic findings (Xia et al., 2021). Workers who perceive their jobs as more hazardous demonstrate higher compliance. However, the effect size was substantially smaller than that of safety motivation and safety climate. Moreover, risk perception did not significantly predict incident involvement in the negative binomial regression (IRR=0.89, p=0.087), suggesting that its effect on incidents is fully mediated by safety compliance.

The finding that risk perception did not differ between direct employees and contract workers (d=0.12, p=0.401) is theoretically important. Contract workers are aware of hazards similarly to direct employees, but this awareness does not translate into behaviour due to motivational and organisational barriers (fear of job loss, weaker safety climate). This aligns with the Theory of Planned Behavior (Ajzen, 1991), which posits that perceived behavioural control—in this case, constrained by job insecurity—moderates the attitude-behaviour relationship.

Theoretical Implications

These findings extend Social Cognitive Theory (Bandura, 1986) to the Nigerian oil and gas context by demonstrating reciprocal determinism between personal factors (safety motivation, risk perception), environmental factors (safety climate), and behaviour (safety compliance). The results also refine the Theory of Planned Behavior (Ajzen, 1991) in a high power-distance, collectivist environment by showing that perceived behavioural control (job security) may be more influential than subjective norms.

The mediation finding (40% of climate effect mediated by motivation) supports the Griffin and Neal (2000) model and suggests that interventions should target both climate and motivation simultaneously. Organisations cannot simply "improve safety climate" and expect immediate compliance improvements; they must also address the motivational pathways through which climate operates.

Practical Implications

For oil and gas companies: Organisations should administer validated behavioural safety assessments (such as the BFOHS-MS) to identify workers with low safety motivation or poor risk perception. Interventions should prioritise enhancing intrinsic safety motivation through positive reinforcement (praise, recognition, linking safety to personal values) rather than purely extrinsic rewards (bonuses, gift cards), which can crowd out intrinsic motivation.

For contract worker safety: The finding that contract workers have lower compliance and are less responsive to safety climate suggests that separate, targeted strategies are needed. These include: extending contract durations to reduce job insecurity; including contract workers in safety committees and recognition programmes; providing equivalent training and PPE; and implementing anonymous near-miss reporting systems with explicit no-blame policies.

For training programmes: Safety training should address not only hazard identification (risk perception) but also motivational and attitudinal components. The Johnson-Neyman threshold of 2.5 on safety motivation (from the parent thesis) indicates that workers scoring below this level require motivational interventions before training becomes effective.

Limitations and Future Research

Several limitations must be acknowledged. First, the cross-sectional design prevents causal inference; reverse causation (compliance influencing climate perceptions) is plausible. Longitudinal studies with two or three waves are needed to establish temporal ordering. Second, self-reported safety compliance may be subject to social desirability bias, though a social desirability covariate was included and common method variance diagnostics were satisfactory. Third, the non-probability sampling limits statistical generalisability, though purposive quota sampling enhanced representativeness on key strata. Fourth, the study was

conducted in a single industry (oil and gas) in one region of Nigeria; generalisability to other industries (construction, mining, manufacturing) and other African oil-producing countries (Angola, Ghana) requires further research.

Future research should: (a) conduct randomised controlled trials of motivational vs training-only interventions; (b) include objective safety outcomes (observed compliance, documented incidents) alongside self-report; (c) examine additional behavioural factors such as safety locus of control and cognitive biases; and (d) replicate the findings in other high-hazard industries and developing economy contexts.

CONCLUSION

This study provides robust empirical evidence that behavioural and organisational variables—particularly safety motivation, safety climate, and risk perception—are critical determinants of occupational safety compliance within Nigeria's petroleum sector. Safety motivation emerged as the strongest predictor, partially mediating the relationship between safety climate and compliance behaviour. Contract workers demonstrated significantly lower safety compliance and were less responsive to safety climate, highlighting their vulnerability. The findings support the integration of behavioural safety interventions into conventional engineering-based safety systems. Organisations should prioritise enhancing intrinsic safety motivation and strengthening organisational safety climate, with targeted strategies for contract workers.

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STATEMENT OF CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The corresponding author affirms that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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