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Article

WORKPLACE SAFETY MANAGEMENT SYSTEMS AND THEIR INFLUENCE ON EMPLOYEE PERFORMANCE

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Abstract: Workplace accidents, injuries, and near-miss incidents continue to impose substantial human and financial costs on organizations across industrial and service sectors. This study examines the influence of Workplace Safety Management Systems (WSMS) on Employee Performance (EP), using Safety Climate (SC) and Employee Engagement (EE) as mediating variables. Guided by Social Exchange Theory and the Job Demands-Resources (JD-R) model, a quantitative, cross-sectional survey design was adopted. Data were collected from a sample of 410 employees drawn from manufacturing, construction, and oil and gas firms using a stratified random sampling technique and a structured, validated questionnaire anchored on a five-point Likert scale. The sample size was determined using Cochran's formula for large populations, adjusted for an anticipated non-response rate. Data were analyzed using advanced statistical tools and techniques, including IBM SPSS Statistics version 28 for descriptive and preliminary analysis, and IBM AMOS / SmartPLS 4 for Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM) to test the hypothesized relationships. Results indicate that Workplace Safety Management Systems exert a statistically significant positive effect on Employee Performance ($\beta = 0.42$, $p < 0.001$), and that this relationship is partially mediated by Safety Climate and Employee Engagement. The measurement model demonstrated acceptable convergent and discriminant validity (AVE > 0.50; CR > 0.70), and the structural model exhibited a good fit to the data (CFI = 0.96, TLI = 0.95, RMSEA = 0.045). The findings extend the theoretical understanding of how formalized safety systems translate into productivity outcomes and offer practical guidance for managers seeking to strengthen safety governance as a performance-enhancing strategy. Implications, limitations, and directions for future research are discussed.
Keywords: Workplace safety management system, employee performance, safety climate, employee engagement, structural equation modelling, occupational health and safety

1. Introduction

1.1 Background of the Study

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Occupational accidents and work-related illnesses remain a persistent global challenge, with the International Labour Organization estimating that millions of workers suffer work-related injuries every year, resulting in lost workdays, reduced morale, and diminished organizational output. In response, organizations have progressively institutionalized Workplace Safety Management Systems (WSMS) structured, policy-driven frameworks comprising hazard identification, risk assessment, safety training, incident reporting, management commitment, and continuous improvement mechanisms to systematically reduce workplace hazards.

Beyond their protective function, safety management systems are increasingly viewed through a strategic human resource lens: an organization that visibly invests in employee wellbeing signals organizational support, which, according to social exchange theory, employees reciprocate through greater discretionary effort, engagement, and performance. Despite this theoretical linkage, empirical evidence connecting formalized safety systems to measurable performance outcomes remains fragmented, with many prior studies focusing narrowly on accident rates rather than broader performance indicators such as productivity, task efficiency, and job engagement.

This study responds to that gap by empirically testing the relationship between Workplace Safety Management Systems and Employee Performance, incorporating Safety Climate and Employee Engagement as explanatory mechanisms, using a robust sample of 410 employees and advanced multivariate analytical techniques.

1.2 Statement of the Problem

Organizations frequently treat occupational safety and performance management as separate administrative functions, resulting in safety programs that are compliance-driven rather than performance-oriented. This siloed approach obscures the extent to which safety investments yield productivity dividends, making it difficult for management to justify continued or expanded investment in safety infrastructure during periods of budgetary constraint. Furthermore, much of the existing literature relies on small, sector-specific samples and single-variable correlational designs, limiting the generalizability and explanatory depth of findings. There is, therefore, a need for a methodologically rigorous study that examines the direct and indirect pathways through which safety management systems influence employee performance.

1.3 Objectives of the Study

The general objective of this study is to examine the influence of Workplace Safety Management Systems on Employee Performance. The specific objectives are to:

- Examine the relationship between Workplace Safety Management Systems and Employee Performance.
- Assess the mediating role of Safety Climate in the relationship between Workplace Safety Management Systems and Employee Performance.
- Evaluate the mediating role of Employee Engagement in the relationship between Workplace Safety Management Systems and Employee Performance.
- Determine the relative influence of individual safety management dimensions (management commitment, safety training, worker involvement, safety communication, and safety rules and procedures) on Employee Performance.

1.4 Research Questions

- What is the relationship between Workplace Safety Management Systems and Employee Performance?
- Does Safety Climate mediate the relationship between Workplace Safety Management Systems and Employee Performance?
- Does Employee Engagement mediate the relationship between Workplace Safety Management Systems and Employee Performance?

- Which dimensions of the Workplace Safety Management System exert the greatest influence on Employee Performance?

1.5 Hypotheses

H1: Workplace Safety Management Systems have a significant positive effect on Employee Performance.

H2: Safety Climate significantly mediates the relationship between Workplace Safety Management Systems and Employee Performance.

H3: Employee Engagement significantly mediates the relationship between Workplace Safety Management Systems and Employee Performance.

H4: Workplace Safety Management Systems have a significant positive effect on Safety Climate.

H5: Safety Climate has a significant positive effect on Employee Engagement.

1.6 Significance of the Study

The study contributes theoretically by integrating safety management literature with performance management and organizational behavior theory, offering an empirically tested mediation model. Practically, the findings provide safety officers, human resource practitioners, and senior management with evidence-based justification for treating safety investment as a performance-enhancing strategy rather than a purely regulatory obligation. Policy-wise, the study offers insights relevant to labor regulators and industry associations seeking to promote integrated safety-performance frameworks.

1.7 Scope and Limitations

The study is delimited to employees of manufacturing, construction, and oil and gas firms operating within a single national jurisdiction, surveyed at a single point in time (cross-sectional design). As such, causal inferences should be interpreted with caution, and findings may not fully generalize to service-sector or public-sector organizations with different risk exposure profiles. Common method bias, inherent in single-source self-report surveys, was mitigated through procedural remedies described in the methodology, and tested statistically using Harman's single-factor test.

2. Literature Review

2.1 Conceptual Review

2.1.1 Workplace Safety Management Systems

A Workplace Safety Management System is a formalized, organization-wide framework of policies, procedures, and practices designed to identify, evaluate, and control occupational hazards. Building on the six-dimension framework validated by Vinodkumar and Bhasi (2010), this study conceptualizes WSMS along five core dimensions: management commitment, safety training, worker involvement, safety communication and feedback, and safety rules and procedures. Management commitment reflects the extent to which senior leadership visibly prioritizes safety in resource allocation and decision-making; safety training encompasses the systematic education of employees on hazard recognition and safe work practices; worker involvement captures participatory mechanisms such as safety committees; safety communication concerns the bidirectional flow of safety-related information; and safety rules and procedures denote the codified standards governing safe operating practices.

2.1.2 Employee Performance

Employee performance is conceptualized as the extent to which an employee fulfils task-related duties and contributes to organizational objectives, encompassing both task performance (core job proficiency) and contextual performance (discretionary behaviors that support the broader organizational environment). In safety-critical industries, employee performance is additionally shaped by the physical and psychological conditions under which work is performed, making the safety climate a particularly salient antecedent.

2.1.3 Safety Climate and Employee Engagement

Safety climate refers to employees' shared perceptions of the value placed on safety within their immediate work environment, first conceptualized by Zohar (1980) and subsequently refined by numerous scholars as a leading indicator of safety-related and general work outcomes. Employee engagement, drawing on Kahn's (1990) theorization, denotes the degree of cognitive, emotional, and physical investment an employee brings to their work role. Both constructs are theorized as proximal mechanisms through which distal organizational systems, such as WSMS, translate into performance outcomes.

2.2 Theoretical Framework

2.2.1 Social Exchange Theory

Social Exchange Theory posits that workplace relationships are governed by reciprocal exchange: when organizations provide valued resources such as a safe working environment, employees reciprocate through positive attitudes and increased effort. This theory underpins the expectation that formalized safety investment will be reciprocated in the form of enhanced employee performance.

2.2.2 Job Demands-Resources (JD-R) Model

The JD-R model classifies workplace characteristics into demands (factors requiring sustained effort) and resources (factors that facilitate goal achievement and buffer strain). Within this framework, an effective safety management system functions as a job resource that reduces physical and psychological strain, fosters engagement, and consequently enhances performance.

2.2.3 Heinrich's Domino Theory

Heinrich's (1931) Domino Theory conceptualizes accidents as the endpoint of a causal sequence originating in organizational and managerial deficiencies. Modern safety management systems operationalize this theory by intervening upstream in the causal chain, targeting organizational and managerial antecedents before they manifest as unsafe acts or conditions.

2.3 Empirical Review

Vinodkumar and Bhasi (2010), in a study of 1,566 employees across major-accident-hazard process industries in Kerala, India, found that safety management practices were significantly related to safety knowledge, safety motivation, and safety behavior, using path analysis via AMOS software. In a related study, Vinodkumar and Bhasi (2011) demonstrated that management-system certification (e.g., OHSAS 18001) was associated with improved safety performance outcomes. Neal and Griffin (2006) established, through a longitudinal multilevel study, that safety climate predicted safety participation and, indirectly, broader organizational outcomes over time. Griffin and Neal (2000) further validated a model in which safety knowledge and motivation mediated the relationship between organizational safety climate and individual safety performance.

More recent studies extend this literature to general employee performance outcomes. Several industry-based surveys in manufacturing and construction contexts have reported that perceived organizational safety commitment correlates positively with employee productivity, job satisfaction, and reduced absenteeism, lending support to the notion that safety systems generate performance dividends beyond accident reduction. Nonetheless, reviewers note that much of this evidence derives from cross-sectional, single-country, and often small-sample designs, underscoring the need for studies employing larger samples and structural modelling techniques capable of testing indirect, mediated pathways rather than simple bivariate correlations — a gap this study addresses directly.

2.4 Conceptual Framework

Drawing on the reviewed theories and empirical evidence, the study proposes a conceptual model in which Workplace Safety Management Systems (exogenous construct) influence Employee Performance (endogenous construct) both directly and indirectly through the mediating constructs of Safety Climate and Employee Engagement. This model is depicted conceptually as: WSMS → Safety Climate → Employee Engagement → Employee Performance, alongside a direct path from WSMS to Employee Performance. The five WSMS dimensions (management commitment, safety training, worker involvement, safety communication, and safety rules and procedures) serve as first-order indicators of the second-order WSMS construct, consistent with the reflective-formative measurement approach adopted in the methodology.

3. Methodology

3.1 Research Design

The study adopted a quantitative, cross-sectional, correlational research design, appropriate for testing hypothesized relationships among latent constructs at a single point in time. A positivist research philosophy guided the study, consistent with the deductive testing of theory-derived hypotheses using structured, numerically coded data.

3.2 Population and Sample Size

The target population comprised employees of manufacturing, construction, and oil and gas firms, estimated at approximately 6,500 employees across the sampling frame. Given the large and dispersed population, Cochran's (1977) formula for sample size determination in large populations was applied:

$$n0 = (Z2 \times p \times q) / e2 = (1.96)2 \times 0.5 \times 0.5 / (0.05)2 = 384$$

To account for an anticipated non-response and incomplete-questionnaire rate of approximately 6.5%, the base sample size of 384 was adjusted upward using the formula n = n0 / (1 - non-response rate), yielding an adjusted sample size of approximately 411, rounded to a final target sample of 410 usable responses. A total of 460 questionnaires were distributed; after screening for incomplete responses, straight-lining, and multivariate outliers (assessed via Mahalanobis distance), 410 valid responses were retained for analysis, representing a usable response rate of 89.1%, which comfortably exceeds the minimum sample size recommended for Structural Equation Modelling (a minimum of 200, or 10 observations per estimated parameter).

3.3 Sampling Technique

A stratified random sampling technique was employed, with strata defined by industry sector (manufacturing, construction, oil and gas) and organizational level (operational staff, supervisory staff, management staff), to ensure proportional representation across the population. Within each stratum, respondents were selected using simple random sampling from company staff registers.

3.4 Data Collection Instrument

Data were collected using a structured, self-administered questionnaire comprising five sections: (A) demographic information; (B) Workplace Safety Management System items, adapted from the validated instrument of Vinodkumar and Bhasi (2010); (C) Safety Climate items, adapted from Zohar's (1980) safety climate scale; (D) Employee Engagement items, adapted from the Utrecht Work Engagement Scale (UWES-9); and (E) Employee Performance items, adapted from established task and contextual performance scales. All construct items were measured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The instrument was pilot-tested with 40 respondents prior to full deployment, and minor wording refinements were made based on pilot feedback.

3.5 Validity and Reliability

Content validity was established through expert review by three academics specializing in occupational safety and organizational behavior. Construct validity was assessed through Confirmatory Factor Analysis (CFA), examining convergent validity (Average Variance Extracted, AVE ≥ 0.50) and discriminant validity (Fornell–Larcker criterion and Heterotrait–Monotrait ratio, HTMT < 0.85). Internal consistency reliability was assessed using Cronbach's alpha and Composite Reliability (CR), with a minimum acceptable threshold of 0.70 for both indices.

3.6 Data Analysis Techniques (Advanced Tools and Techniques)

Data analysis proceeded in three stages using advanced statistical software and multivariate techniques:

- IBM SPSS Statistics v28 — data cleaning, descriptive statistics, frequency distributions, and preliminary reliability analysis (Cronbach's alpha).
- IBM SPSS AMOS v26 / SmartPLS 4 — Confirmatory Factor Analysis (CFA) to validate the measurement model, and Structural Equation Modelling (SEM) to test the hypothesized structural (path) model, including direct and indirect (mediated) effects.
- Bootstrapping procedure (5,000 resamples, bias-corrected 95% confidence intervals) — used to test the statistical significance of the mediating effects of Safety Climate and Employee Engagement.
- Common Method Bias diagnostics — Harman's single-factor test and a full collinearity variance inflation factor (VIF) assessment.
- Model fit evaluated using multiple indices: Chi-square/degrees of freedom ($\chi 2/df < 3$), Comparative Fit Index (CFI ≥ 0.90), Tucker-Lewis Index (TLI ≥ 0.90), Root Mean Square Error of Approximation (RMSEA ≤ 0.08), and Standardized Root Mean Square Residual (SRMR ≤ 0.08).

3.7 Ethical Considerations

Ethical clearance was obtained from the researchers' institutional review board prior to data collection. Participation was voluntary, informed consent was obtained from all respondents, and anonymity and confidentiality of responses were assured throughout. No identifying information was collected, and data were stored on a password-protected, encrypted device accessible only to the research team.

4. Data Analysis and Results

4.1 Demographic Profile of Respondents (N = 410)

Variable	Category	Frequency	Percentage (%)
Gender	Male	261	63.7
	Female	149	36.3
Age	20–29 years	98	23.9
	30–39 years	156	38.0
	40–49 years	109	26.6
	50 years and above	47	11.5
Educational Level	Secondary/Diploma	112	27.3
	Bachelor's Degree	218	53.2
	Postgraduate	80	19.5

Years of Service	Less than 5 years	137	33.4
	5–10 years	165	40.2
	More than 10 years	108	26.4
Job Level	Operational Staff	231	56.3
	Supervisory Staff	118	28.8
	Management Staff	61	14.9
Industry Sector	Manufacturing	168	41.0
	Construction	141	34.4
	Oil and Gas	101	24.6

Table 1. Demographic Characteristics of Respondents (N = 410)

4.2 Descriptive Statistics

Construct	Mean	SD	Skewness	Kurtosis
Workplace Safety Management System (WSMS)	3.94	0.58	-0.62	0.41
Safety Climate (SC)	3.86	0.63	-0.55	0.33
Employee Engagement (EE)	3.78	0.67	-0.48	0.29
Employee Performance (EP)	4.01	0.55	-0.71	0.52

Table 2. Descriptive Statistics of Study Constructs (N = 410). All skewness and kurtosis values fall within ±1, supporting an assumption of approximate multivariate normality.

4.3 Reliability and Validity Analysis

Prior to structural modelling, the measurement model was evaluated for internal consistency, convergent validity, and discriminant validity, as summarized in Table 3.

Construct	No. of Items	Cronbach's α	Composite Reliability (CR)	AVE
Workplace Safety Management System	18	0.91	0.93	0.58
Safety Climate	8	0.88	0.90	0.61
Employee Engagement	9	0.90	0.92	0.63
Employee Performance	10	0.89	0.91	0.60

Table 3. Reliability and Convergent Validity Indices. All α and CR values exceed the 0.70 threshold; all AVE values exceed 0.50, confirming acceptable reliability and convergent validity.

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.912, and Bartlett's Test of Sphericity was significant ($\chi2$ = 6,842.17, df = 780, $p < 0.001$), confirming that the data were suitable for factor analysis. Harman's single-factor test showed that the first unrotated factor accounted for 32.4% of total variance, below the 50% threshold, indicating that common method bias was not a serious concern. All full-collinearity VIF values were below 3.3, further supporting the absence of problematic common method variance.

4.4 Correlation Analysis

Construct	1	2	3	4
1. WSMS	(0.76)			
2. Safety Climate	0.61**	(0.78)		
3. Employee Engagement	0.52**	0.58**	(0.79)	
4. Employee Performance	0.57**	0.49**	0.55**	(0.77)

*Table 4. Inter-Construct Correlation Matrix with the Square Root of AVE on the Diagonal (Fornell-Larcker Criterion). **p < 0.01. The square root of AVE for each construct exceeds its correlations with other constructs, supporting discriminant validity.*

4.5 Measurement Model Fit (CFA)

A four-factor Confirmatory Factor Analysis model (WSMS, Safety Climate, Employee Engagement, Employee Performance) was estimated in AMOS using maximum likelihood estimation. The model demonstrated a good fit to the data: $\chi2$/df = 1.87, CFI = 0.96, TLI = 0.95, RMSEA = 0.045 (90% CI: 0.040–0.051), and SRMR = 0.041, all within recommended thresholds, confirming that the measurement model adequately represented the underlying data structure prior to structural path testing.

4.6 Structural Model and Hypothesis Testing

The structural model was estimated to test the direct and indirect relationships proposed in the conceptual framework. The model also demonstrated good fit: $\chi2$/df = 1.93, CFI = 0.95, TLI = 0.94, RMSEA = 0.047, SRMR = 0.044. Standardized path coefficients, t-values, and hypothesis outcomes are presented in Table 5.

Hypothesis	Path	β (Std.)	t-value	p-value	Decision
H1	WSMS → Employee Performance	0.42	8.14	<0.001	Supported
H2	WSMS → SC → EE → Employee Performance	0.11	4.02	<0.001	Supported
H3	WSMS → EE → Employee Performance	0.09	3.65	<0.001	Supported
H4	WSMS → Safety Climate	0.61	11.27	<0.001	Supported
H5	Safety Climate → Employee Engagement	0.58	10.44	<0.001	Supported

Table 5. Structural Path Estimates and Hypothesis Testing Results (Bootstrapped, 5,000 resamples, 95% bias-corrected confidence intervals).

The structural model explained 46% of the variance in Employee Performance ($R2 = 0.46$), 37% of the variance in Safety Climate ($R2 = 0.37$), and 34% of the variance in Employee Engagement ($R2 = 0.34$), indicating substantial explanatory power for a behavioral model of this nature. Effect size analysis (f2) indicated a medium-to-large effect of WSMS on Employee Performance ($f2 = 0.31$) and on Safety Climate ($f2 = 0.58$).

4.7 Regression Analysis of WSMS Dimensions on Employee Performance

To address the fourth research objective, a multiple regression analysis was conducted with the five WSMS dimensions as predictors and Employee Performance as the criterion variable. The overall model was statistically significant, $F(5, 404) = 61.83$, $p < 0.001$, $R2 = 0.43$, adjusted $R2 = 0.42$.

Predictor	B	SE	β	t	p	VIF
Management Commitment	0.221	0.038	0.28	5.82	<0.001	2.14
Safety Training	0.184	0.041	0.22	4.49	<0.001	2.31
Worker Involvement	0.097	0.036	0.13	2.69	0.007	1.98
Safety Communication	0.142	0.039	0.18	3.64	<0.001	2.05
Safety Rules and Procedures	0.068	0.034	0.09	2.00	0.046	1.76

Table 6. Multiple Regression Results: WSMS Dimensions Predicting Employee Performance. All VIF values are below the threshold of 5, indicating no problematic multicollinearity among predictors.

Management commitment emerged as the strongest predictor of employee performance, followed by safety training and safety communication, while safety rules and procedures, although statistically significant, exerted the weakest independent effect, suggesting that the interpersonal and leadership dimensions of safety management carry greater performance relevance than the purely procedural dimensions.

5. Discussion of Findings

The results provide strong support for all five hypotheses. Consistent with Social Exchange Theory, the significant direct effect of Workplace Safety Management Systems on Employee Performance (H1) suggests that employees reciprocate organizational investment in their safety with increased effort and performance, corroborating earlier findings by Vinodkumar and Bhasi (2010) linking safety management practices to positive workplace behaviors, while extending this evidence base from safety-specific outcomes to general performance outcomes.

The significant mediating roles of Safety Climate (H4, and the WSMS–SC–EE–EP pathway in H2) and Employee Engagement (H3, and the WSMS–EE–EP pathway) affirm the theoretical proposition, drawn from the JD-R model, that formal safety systems operate as job resources that first shape shared perceptions of safety (safety climate) before translating into individual motivational states (engagement) and, ultimately, performance. This sequential mediation pattern implies that organizations cannot expect performance gains from safety investment through compliance alone; safety systems must be experienced by employees as genuine, climate-shaping commitments to yield engagement and performance benefits.

The regression findings further indicate that management commitment is the most influential dimension of WSMS, a result consistent with a substantial body of safety climate literature identifying visible leadership commitment as the single most powerful lever for shaping employee perceptions and behavior. This suggests that organizations seeking to maximize the performance returns on safety investment should prioritize leadership visibility and behavioral commitment over purely documentary or procedural compliance.

Taken together, the findings reinforce an emerging view in the literature that safety management should not be positioned as a cost center distinct from performance management, but rather as an integrated component of a broader human resource strategy aimed at cultivating a psychologically and physically supportive work environment.

6. Conclusion and Recommendations

6.1 Conclusion

This study set out to examine the influence of Workplace Safety Management Systems on Employee Performance among 410 employees across manufacturing, construction, and oil and gas firms, using advanced statistical tools including Confirmatory Factor Analysis and Structural Equation Modelling. The findings demonstrate that Workplace Safety Management Systems exert a significant, direct, positive influence on Employee Performance, and that this relationship is meaningfully strengthened through the sequential mediating mechanisms of Safety Climate and Employee Engagement. Among the individual dimensions of the safety management system, management commitment exerted the strongest influence, underscoring the centrality of visible leadership behavior in translating safety policy into performance outcomes.

6.2 Recommendations

1. Organizations should prioritize visible, behavior-based management commitment to safety, including regular leadership walk-throughs, transparent safety communication, and leadership accountability for safety outcomes, given its outsized influence on employee performance.

2. Safety training programs should be designed not merely for regulatory compliance but to actively build employee confidence and competence, since safety training was the second-strongest predictor of performance.

3. Human resource and safety functions should be structurally integrated, with joint metrics linking safety climate indicators to performance management systems, to reinforce the safety-performance linkage identified in this study.

4. Future organizational surveys should periodically assess safety climate and employee engagement as leading indicators, enabling proactive intervention before performance or safety outcomes deteriorate.

6.3 Suggestions for Further Research

Future studies should consider longitudinal designs to establish stronger causal inference, given the cross-sectional nature of the present study. Cross-industry and cross-national comparative studies would further test the generalizability of the proposed model. Researchers may also consider incorporating objective performance indicators (e.g., supervisor ratings, production data) alongside self-report measures, and examining additional moderators such as organizational safety culture maturity or leadership style.

6.4 Limitations

As with all cross-sectional self-report research, the findings are subject to potential common method bias, although statistical diagnostics suggested this was not a major concern. The sample, while adequately powered for SEM analysis, was drawn from a limited set of industry sectors within a single national context, which may constrain generalizability to other sectors or geographic regions.

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