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Developing a Safety Culture through Effective Management Systems: Considering Outcomes from Various Management System Models

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ABSTRACT

The critical role of Safety Management Systems (SMS) in developing a robust safety culture is widely acknowledged, yet the specific components that most effectively drive cultural outcomes require further investigation. This study investigates the relationship between the effectiveness of key SMS components and safety culture maturity within organizational settings. Employing a mixed-methods design, the research integrates quantitative analyses, including multiple regression to examine the predictive power of various SMS elements, with qualitative insights from thematic analysis of interviews with safety leaders and employees. The findings reveal that leadership commitment and accountability, employee participation and consultation, and proactive risk assessment are the most significant predictors of a positive safety culture, while overly bureaucratic components like documentation and operational control show a negligible direct impact. The study highlights that the success of an SMS in fostering culture is contingent upon strategic prioritization of human and proactive factors over procedural adherence. Practical recommendations include intensifying visible leadership engagement, formalizing empowered employee participation channels, and revitalizing management review processes to focus on cultural and leading indicators. These findings provide a clear framework for organizations to optimize their safety management systems to achieve genuine and enduring cultural transformation.

Keywords: Safety Management Systems, Safety Culture, Leadership Commitment, Employee Participation, Risk Assessment, Organizational Safety

INTRODUCTION

Workplace safety continues to be a central concern in both developed and developing economies due to its direct impact on human well-being, productivity, and organizational sustainability. Despite significant progress in occupational health and safety (OHS) over the past decades, accidents, injuries, and work-related illnesses remain prevalent across industries, resulting in economic losses and social disruptions. According to the International Labour Organization (ILO), more than 2.8 million people die annually from occupational accidents or work-related diseases, while an additional 374 million suffer from non-fatal work-related injuries globally. These alarming statistics underline the urgent need for organizations to move beyond compliance-oriented safety programs and develop a deeper safety culture that embeds safety principles into everyday practices and values.

The concept of safety culture gained prominence in the aftermath of catastrophic industrial accidents such as the Chernobyl nuclear disaster in 1986, which highlighted that technical failures alone could not explain organizational safety breakdowns. Instead, cultural and managerial factors—such as poor communication, inadequate risk awareness, and weak management systems—played pivotal roles. Since then, safety culture has been widely acknowledged as a multidimensional construct encompassing attitudes, behaviors, policies, and leadership commitments that together create an environment where safety is prioritized. A strong safety culture does not only minimize risks but also fosters employee engagement, improves organizational reputation, and ensures long-term resilience.

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Central to the development of a safety culture is the implementation of structured management systems that provide frameworks for identifying risks, implementing controls, and continuously improving safety performance. Models such as ISO 45001 (Occupational Health and Safety Management Systems), OHSAS 18001, Total Quality Management (TQM), and Integrated Management Systems (IMS) offer structured approaches to institutionalizing safety practices. These models emphasize leadership accountability, worker participation, risk-based thinking, continuous improvement, and alignment with organizational strategy. The outcomes of these management systems—such as reduced accidents, improved compliance, and enhanced worker well-being—have demonstrated that safety management cannot be achieved through ad hoc interventions but requires systematic approaches integrated into organizational processes.

The effectiveness of safety management systems varies across industries and organizational contexts. For example, ISO 45001 emphasizes proactive hazard identification and continual improvement, while TQM prioritizes employee involvement and quality-driven performance. Integrated Management Systems seek to combine safety, quality, and environmental standards into one cohesive framework, thereby maximizing efficiency and reducing duplication of efforts. Comparative studies have shown that organizations adopting robust management systems tend to demonstrate stronger safety performance and more resilient safety cultures than those without such systems. However, challenges persist in translating the principles of these models into practice. Resource limitations, resistance to change, insufficient training, and weak enforcement mechanisms often undermine the intended outcomes, especially in developing countries where organizational resources are limited.

In Ghana and other emerging economies, the issue of workplace safety is particularly pressing. The rapid expansion of industries such as construction, mining, oil and gas, and manufacturing has exposed workers to heightened safety risks. While regulatory frameworks exist, enforcement remains inconsistent, and many organizations lack the structures or resources to effectively implement internationally recognized safety management systems. Consequently, workplace accidents and hazards are still prevalent, undermining productivity and contributing to socioeconomic costs. Developing a safety culture through effective management systems is therefore not only a regulatory obligation but also a strategic imperative for organizations seeking sustainable growth.

Moreover, global competitiveness increasingly demands adherence to international safety standards. Multinational corporations and supply chain networks expect partners to demonstrate robust safety management practices as part of corporate social responsibility and ethical business conduct. This reinforces the need for Ghanaian organizations to align with global best practices by adopting proven management system models that cultivate safety culture. Beyond compliance, these systems provide opportunities for organizations to strengthen their human capital, reduce operational disruptions, and build trust with stakeholders.

Despite the recognized importance of safety culture and management systems, there remain critical gaps in understanding the interplay between the two. Much of the literature has focused on either describing safety culture as a standalone concept or analyzing the technical aspects of management systems without adequately exploring how these systems shape, reinforce, or hinder safety culture in practice. Furthermore, comparative analyses of outcomes across different management system models are relatively scarce, leaving managers with limited evidence on which approaches are most effective in their contexts. This study seeks to address these gaps by examining how various management system models contribute to the development of safety culture and what outcomes they generate for organizations.

Statement of the Problem

While the importance of workplace safety is universally acknowledged, organizations continue to grapple with persistent challenges in embedding safety into their everyday operations. Despite the existence of structured management systems and international standards, workplace accidents and occupational hazards remain significant issues. In many cases, organizations adopt management system models such as ISO 45001 or TQM primarily to satisfy regulatory or certification requirements, but fail to internalize the principles necessary for

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cultivating a genuine safety culture. This superficial implementation creates a situation where systems exist on paper but fail to influence behaviors, attitudes, and decision-making in practice.

In Ghana, the situation is particularly concerning given the high-risk nature of sectors such as mining, construction, and manufacturing. Accidents in these industries often result in severe injuries or fatalities, with ripple effects on families, communities, and the economy. Although legal frameworks such as the Factories, Offices and Shops Act and the Labour Act provide guidelines on occupational safety, enforcement remains weak and compliance inconsistent. Many organizations struggle with resource constraints, lack of trained personnel, and cultural barriers that limit effective safety practices. As a result, safety culture remains underdeveloped, and management systems often fail to deliver their intended outcomes.

Moreover, research has shown that while management systems can enhance safety performance, the outcomes vary significantly depending on how the systems are implemented and contextualized. For instance, ISO 45001 emphasizes risk-based approaches and leadership involvement, yet in many Ghanaian organizations, leadership engagement is minimal and worker participation limited. Similarly, TQM-driven approaches that prioritize employee involvement may falter in environments where communication channels are weak and hierarchical decision-making dominates. Integrated Management Systems, while efficient in theory, may overwhelm organizations that lack adequate technical capacity or financial resources. This raises critical questions about the adaptability and effectiveness of different management system models in fostering safety culture within Ghanaian and similar contexts.

Another pressing issue lies in the limited empirical evidence on the comparative outcomes of different management system models. While some studies highlight reduced accident rates or improved compliance as benefits of ISO 45001, others point to enhanced employee engagement under TQM approaches. Few studies, however, have systematically analyzed how these different models contribute to the deeper cultural dimensions of safety—such as attitudes, shared values, and organizational learning. Without such evidence, managers and policymakers are left without clear guidance on which models or practices are most suitable for their organizational realities.

Therefore, the problem that this study seeks to address is the lack of a comprehensive understanding of how various management system models influence the development of safety culture and what specific outcomes they generate. In the Ghanaian context, this problem is compounded by limited resources, weak enforcement of regulations, and cultural dynamics that often prioritize production over safety. Unless organizations develop effective management systems that go beyond compliance to actively foster safety culture, workplace accidents will persist, undermining productivity, eroding trust, and impeding sustainable development.

Purpose of the Study

The purpose of this study is to examine how effective management systems contribute to the development of a safety culture in organizations, with particular attention to the outcomes associated with different management system models. By analyzing frameworks such as ISO 45001, Total Quality Management (TQM), and Integrated Management Systems (IMS), the study seeks to understand not only the technical compliance aspects of safety management but also the deeper cultural shifts that such systems can foster within organizations. This inquiry is particularly significant in the Ghanaian context, where resource limitations, regulatory enforcement challenges, and cultural dynamics continue to hinder the advancement of robust safety practices. Ultimately, the study aims to provide evidence-based insights that can guide managers, policymakers, and practitioners in strengthening safety culture as a pathway to improved workplace well-being, organizational resilience, and sustainable growth.

Research Objectives

General Objective

The general objective of this study is to explore how the adoption of effective management systems can

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facilitate the development of a strong safety culture, drawing lessons from the outcomes of various system models.

Specific Objectives

1. To evaluate how ISO 45001 contributes to the development of safety culture in organizations.
2. To examine the role of Total Quality Management (TQM) in promoting safety culture through employee participation and continuous improvement.
3. To analyze the effectiveness of Integrated Management Systems (IMS) in harmonizing safety with other organizational priorities such as quality and environmental management.
4. To compare the outcomes of different management system models in terms of safety performance and cultural transformation.

LITERATURE REVIEW

Theoretical Framework

The theoretical foundation for this study is built upon a synthesis of three pivotal theories that explain how management systems influence the development of a robust safety culture: Edgar Schein's Model of Organizational Culture, the Plan-Do-Check-Act (PDCA) Cycle from quality management systems, and James Reason's concept of a "Informed Culture." These theories collectively provide a multi-faceted lens to understand the mechanisms through which formal management systems shape shared values, behaviors, and safety outcomes.

Edgar Schein's Model of Organizational Culture, developed by Schein (1985), posits that organizational culture exists on three levels: artifacts (visible structures and processes), espoused values (strategies, goals, and philosophies), and basic underlying assumptions (unconscious, taken-for-granted beliefs and perceptions). Applying this model to safety culture suggests that an effective safety management system (SMS) acts as a tangible artifact that promotes specific espoused values like "safety first." Over time, and through consistent reinforcement by management, these values can become basic underlying assumptions—the deep-seated core of a safety culture where safe behavior is automatic and non-negotiable. This framework helps explain how a management system is not merely a procedural document but a cultural intervention tool.

The Plan-Do-Check-Act (PDCA) Cycle, central to management system standards like ISO 45001, provides the structural engine for continuous improvement in safety performance. The model involves Planning (establishing objectives and processes), Doing (implementing the processes), Checking (monitoring and measuring performance against the policy and objectives), and Acting (taking actions to continually improve). In the context of safety culture, the PDCA cycle offers a dynamic model for understanding how management systems move beyond static rules to create a learning environment. The "Check" and "Act" stages are particularly critical, as they institutionalize organizational learning from incidents and audits, thereby fostering an adaptive and proactive culture rather than a reactive one.

James Reason's Informed Culture, a component of his broader "Safety Culture" concept, describes a culture in which those who manage and operate the system have current knowledge about the human, technical, organizational, and environmental factors that determine the safety of the system as a whole. An effective safety management system is the primary vehicle for creating this "informed state." It provides the structure for collecting and analyzing safety data (e.g., from incident reports, audits, and leading indicators), and for disseminating this information throughout the organization. An Informed Culture is therefore not a happy accident; it is a direct outcome of a management system that prioritizes visibility, feedback, and organizational learning.

By integrating these three theoretical perspectives, this study establishes a comprehensive framework for

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analyzing the outcomes of various management system models. Schein's model explains the cultural internalization process, the PDCA cycle provides the operational mechanism for continuous improvement, and Reason's concept defines the desired cultural state of being informed. Together, they allow the study to examine not only the structural components of different management systems (e.g., OHSAS 18001, ISO 45001, bespoke models) but also how their implementation influences managerial commitment, employee engagement, learning processes, and, ultimately, the internalization of safety as a core value. This framework guides the research by focusing the analysis on key variables such as management system type, level of employee participation, effectiveness of feedback loops, and measurable safety culture indicators.

Empirical Review

Empirical research has consistently demonstrated a strong, positive correlation between the implementation of formalized safety management systems (SMS) and the development of a positive safety culture, though the outcomes are highly dependent on the model's design and the quality of its execution. Studies examining the transition from OHSAS 18001 to the more proactive ISO 45001 standard have provided valuable insights. For instance, a longitudinal study by Fernández-Muñiz et al. (2018) found that organizations certified to ISO 45001 reported significantly higher levels of safety climate, measured by employee perceptions of management commitment and safety systems, compared to those with OHSAS 18001 or no certification. The authors attributed this to ISO 45001's stronger emphasis on leadership involvement, worker participation, and risk-based thinking, which are key drivers of cultural change.

The role of leadership and management commitment, a central component of most SMS models, has been repeatedly validated as a critical success factor. Research by Guo et al. (2021) in the construction industry demonstrated that the effectiveness of an SMS was heavily mediated by visible leadership actions. In cases where senior managers actively participated in safety walks, allocated resources, and were held accountable for safety outcomes, the SMS served as a powerful catalyst for a positive culture. Conversely, when the SMS was perceived as a mere "paperwork exercise" decoupled from daily operations and managerial priorities, its impact on culture was negligible or even negative, fostering cynicism among workers.

Furthermore, empirical evidence highlights the importance of specific SMS elements in shaping cultural outcomes. Studies have shown that the effectiveness of the "Check" and "Act" phases of the PDCA cycle is crucial. Organizations that excel in incident investigation, proactive monitoring of leading indicators, and the implementation of corrective actions are more successful in building a learning culture (Podgórski, 2019). For example, a meta-analysis by Clarke (2020) concluded that SMS which incorporated robust employee participation mechanisms—such as safety committees and empowered worker representatives—were significantly more effective in reducing incident rates and improving safety compliance. This aligns with the theoretical notion that participation helps transform espoused values into shared assumptions.

However, the empirical literature also reveals significant limitations and contextual challenges. The "one-sizefits-all" application of complex SMS models in small and medium-sized enterprises (SMEs) has often been identified as a barrier. Studies by Hasle & Limborg (2019) found that SMEs frequently struggle with the bureaucratic burden of formal systems, leading to superficial implementation that fails to engender genuine cultural change. Additionally, the integration of the SMS with other core business processes (e.g., production, quality) is a recurring challenge. Research by Borys et al. (2020) indicates that SMS models that remain siloed within the HSE department, rather than being integrated into overall business management, have a limited impact on the broader organizational culture.

METHODOLOGY

This study employed a mixed-methods research design to comprehensively investigate the role of effective management systems in developing a robust safety culture, with a specific focus on comparing outcomes from various models. The mixed-methods approach was chosen to integrate the strengths of both quantitative and qualitative methodologies, allowing for a holistic understanding of the relationship between management system components, employee perceptions, and tangible safety performance indicators. Creswell and Plano

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Clark (2018) emphasize that mixed-methods designs are particularly effective when research requires both the measurement of relationships among variables and an in-depth exploration of contextual experiences and underlying mechanisms.

The quantitative component of the study targeted employees, safety officers, and mid-level managers across diverse industries known to have implemented formal safety management systems, such as manufacturing, construction, energy, and healthcare. The population included organizations utilizing various models, including ISO 45001, OHSAS 18001, and bespoke internal safety frameworks. Stratified random sampling was employed to ensure representation across industry type, organizational size, and the specific management system model in use. A total of 300 respondents participated in a structured survey using standardized instruments, including measures of safety culture perceptions (e.g., management commitment, safety systems, worker involvement), safety performance outcomes (e.g., incident rates, near-miss reporting rates), and the perceived effectiveness of key management system elements. Quantitative data were analyzed using descriptive statistics, correlation analysis, and multiple regression analyses to assess the relationships between management system characteristics, safety culture maturity, and safety outcomes.

For the qualitative component, purposive sampling was used to select 35 key informants from the broader survey population, including senior safety managers, operational leaders, and frontline employees with direct experience in the implementation and operation of the safety management systems. Semi-structured interviews and focus group discussions were conducted to explore participants' experiences with different management system models, perceived drivers and barriers to developing a safety culture, the role of leadership, and the practical challenges of system integration and maintenance. Interviews were conducted in participants' preferred languages, audio-recorded with consent, and transcribed verbatim. Thematic analysis, following Braun and Clarke's (2006) six-phase process, was used to identify patterns, recurring themes, and nuanced insights into how management systems either foster or hinder a genuine safety culture. Coding was conducted manually by two independent researchers to enhance credibility and minimize bias.

Ethical considerations were strictly observed throughout the study. Ethical approval was obtained from the relevant institutional review board prior to data collection. Participants received detailed information sheets explaining the study's objectives, confidentiality assurances, voluntary participation, and the right to withdraw at any time without consequence. Informed consent was obtained in writing from all participants. Data were anonymized using alphanumeric codes, and all digital and physical records were securely stored with restricted access to the research team.

By combining quantitative and qualitative methods, this study was able to capture both the measurable correlations between management systems and safety culture and the rich, contextual narratives that explain *how* and *why* these relationships manifest. This methodological approach allows for a nuanced understanding of how different management system models interact with leadership practices, employee behaviors, and organizational processes to ultimately shape the safety culture, providing evidence-based insights to inform the selection, design, and implementation of effective safety management systems.

Analysis and Discussion of Results

This section presents a descriptive analysis of the key components of Safety Management Systems (SMS) and their perceived effectiveness in fostering a positive safety culture, as reported by the sampled organizations. The purpose of this analysis is to provide an overview of which SMS elements are considered most critical and effective by employees and managers. Eight key components, derived from common models like ISO 45001, were evaluated based on participants' responses using a Likert-scale format (1 = Very Ineffective, 5 = Very Effective).

Table 1: Evaluation of Safety Management System Components

SMS Component	Mean Score	Standard Deviation
Leadership Commitment & Accountability	4.45	0.71

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Employee Participation & Consultation	4.20	0.82
Risk Assessment & Hazard Control	4.35	0.75
Incident Investigation & Corrective Action	4.10	0.88
Safety Training & Competence	4.02	0.90
Performance Monitoring & Measurement	3.95	0.95
Management Review & Continuous Improvement	3.78	1.02
Documentation & Operational Control	3.65	1.10

The descriptive statistics indicate that Leadership Commitment & Accountability received the highest mean score (M = 4.45), suggesting it is perceived as the most critical and effective component for developing a strong safety culture. Risk Assessment & Hazard Control (M = 4.35) and Employee Participation & Consultation (M = 4.20) also scored highly, underscoring the importance of proactive risk management and inclusive engagement.

Components such as Incident Investigation (M = 4.10) and Safety Training (M = 4.02) were also viewed as effective but showed slightly more variability in perception. In contrast, Performance Monitoring (M = 3.95), Management Review (M = 3.78), and Documentation (M = 3.65) had the lowest mean scores. This suggests that while these latter components are recognized parts of an SMS, they may be perceived as more bureaucratic and less directly impactful on cultural development, or they may be less effectively implemented in practice.

Overall, the analysis demonstrates that the human and proactive elements of an SMS—leadership, employee involvement, and risk management—are viewed as the most potent drivers of safety culture. The variation in scores highlights a potential gap between the implementation of procedural elements and those that genuinely shape beliefs and behaviors, providing a foundation for investigating their statistical impact on safety outcomes.

Objective 2: To Examine the Statistical Relationship Between Management System Effectiveness and Safety Culture Outcomes

This section investigates the extent to which the effectiveness of the Safety Management System (SMS) components influences key safety culture outcomes, including safety compliance, safety participation, and reduced incident rates. A multiple regression analysis was conducted to quantify the relationship between the SMS components (independent variables) and a composite measure of safety culture maturity (dependent variable).

Table 2: Regression Analysis of SMS Components on Safety Culture Maturity

Predictor Variable (SMS Component)	**B**	**SE B**	**Beta (β)**	**t-value**	**p-value**
(Constant)	0.451	0.205		2.200	0.029
Leadership Commitment & Accountability	0.385	0.062	0.365	6.210	0.000
Employee Participation & Consultation	0.295	0.068	0.268	4.338	0.000
Predictor Variable (SMS Component)	**B**	**SE B**	**Beta (β)**	**t-value**	**p-value**
Risk Assessment & Hazard Control	0.255	0.071	0.230	3.592	0.000
Incident Investigation & Corrective Action	0.188	0.074	0.170	2.541	0.012
Safety Training & Competence	0.165	0.070	0.152	2.357	0.019
Performance Monitoring & Measurement	0.120	0.072	0.108	1.667	0.097

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Management Review & Continuous Improvement	0.095	0.079	0.082	1.203	0.230
Documentation & Operational Control	0.058	0.075	0.051	0.773	0.440

Model Summary

$R^2 = 0.52$, Adjusted $R^2 = 0.50$, $F(8, 291) = 39.45$, $p < 0.001$

The regression results reveal that the overall model is statistically significant ($F = 39.45$, $p < 0.001$), indicating that the combined SMS components significantly predict safety culture maturity. The R^2 value of 0.52 indicates that approximately 52% of the variance in safety culture outcomes can be explained by the effectiveness of these eight SMS components.

Leadership Commitment & Accountability emerged as the strongest predictor ($\beta = 0.365$, $p < 0.001$), reinforcing the descriptive findings and confirming its paramount role. Employee Participation & Consultation ($\beta = 0.268$, $p < 0.001$) and Risk Assessment & Hazard Control ($\beta = 0.230$, $p < 0.001$) were also highly significant and strong predictors, highlighting that cultural development is driven by both top-down commitment and bottom-up involvement in a proactive risk management framework.

Incident Investigation ($\beta = 0.170$, $p = 0.012$) and Safety Training ($\beta = 0.152$, $p = 0.019$) showed moderate but statistically significant impacts, confirming their role in reinforcing learning and competence. In contrast, Performance Monitoring ($\beta = 0.108$, $p = 0.097$), Management Review ($\beta = 0.082$, $p = 0.230$), and Documentation ($\beta = 0.051$, $p = 0.440$) did not achieve statistical significance as direct predictors in this model. This suggests that while these elements are foundational to a system, their effectiveness in directly shaping culture is likely mediated through the more influential components like leadership and employee participation.

DISCUSSION OF RESULTS

The results of this study provide compelling evidence that the effectiveness of a Safety Management System (SMS) is a powerful determinant of safety culture maturity, with specific components playing disproportionately critical roles. The finding that Leadership Commitment and Accountability is the single strongest predictor ($\beta = 0.365$, $p < 0.001$) aligns seamlessly with the theoretical framework of Schein's model, where leadership actions are the primary force in establishing and embedding espoused safety values into underlying assumptions. This finding is strongly supported by empirical work, such as that of Guo et al. (2021), which consistently identifies visible leadership as the non-negotiable foundation upon which a positive safety culture is built.

The significant influence of Employee Participation and Consultation ($\beta = 0.268$, $p < 0.001$) and Risk Assessment and Hazard Control ($\beta = 0.230$, $p < 0.001$) underscores the synergistic relationship between human factors and technical-systematic processes. This resonates with the integrated theoretical lens of the PDCA cycle and Reason's Informed Culture. Employee participation ensures the "Do" and "Check" phases are grounded in frontline reality, while proactive risk assessment is the core of the "Plan" phase. Together, they create a learning loop that empowers employees and provides the data needed for an "informed" organization, as emphasized by Podgórski (2019) and Clarke (2020).

The moderate but significant impact of Incident Investigation and Safety Training indicates their vital role as reinforcing mechanisms. They are essential for converting experiences (both negative and positive) into shared knowledge and competencies, thereby solidifying the cultural norms. However, the non-significant results for Performance Monitoring, Management Review, and Documentation are highly instructive. They do not imply these components are unimportant; rather, they suggest that when implemented in isolation or as bureaucratic exercises, they have limited direct impact on cultural perceptions. This finding empirically validates the challenges noted by Hasle & Limborg (2019) and Borys et al. (2020), where systems can become decoupled from the lived culture, existing as "paper systems" that fail to engage the human element. Their value is likely

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contingent on being actively used by leadership to drive discussion and decision-making (Management Review) and being seen as tools for improvement rather than control (Performance Monitoring).

In summary, the findings powerfully demonstrate that developing a safety culture through management systems is not about implementing all components equally, but about strategically prioritizing and deeply integrating the core cultural drivers. The most effective systems are those where strong leadership uses the framework of the SMS—particularly its elements of participation and risk assessment—to foster an environment of trust, learning, and shared responsibility. The results provide a clear mandate for organizations to focus their efforts on the human-centric and proactive components of their management systems to achieve genuine cultural transformation.

CONCLUSION AND RECOMMENDATION

The findings of this study underscore the pivotal role of effective Safety Management Systems (SMS) in cultivating a robust and positive safety culture within modern organizations. The analyses reveal that not all SMS components contribute equally to cultural development; rather, the human-centric and proactive elements—specifically Leadership Commitment & Accountability, Employee Participation & Consultation, and Risk Assessment & Hazard Control—are the most significant drivers of safety culture maturity. The regression analysis demonstrated that these components collectively explain a substantial portion of the variance in safety outcomes, with leadership emerging as the single most powerful predictor. This confirms that a safety culture is not an accidental by-product but a direct consequence of strategic, system-driven interventions that prioritize visible leadership and empower employee engagement. These findings align with and reinforce the core tenets of the established theoretical framework, particularly Schein's model of cultural internalization and Reason's concept of an Informed Culture (Schein, 1985; Reason, 1997).

Despite the clear value of a well-implemented SMS, the study also highlights critical limitations and implementation challenges. The relatively weak direct impact of components like Documentation, Management Review, and Performance Monitoring indicates a common pitfall where systems become bureaucratically decoupled from daily operations and human perception. When these elements are treated as paper-based compliance exercises rather than living tools for continuous improvement and leadership engagement, their potential to influence culture is severely diminished. This resonates with empirical studies that point to the "proceduralization" of safety as a barrier to genuine cultural internalization, especially in contexts lacking strong mid-management ownership or organizational resources for meaningful implementation (Borys et al., 2020).

Based on the study's findings, the following key recommendations are proposed for organizations seeking to leverage their management systems for cultural development:

1. Prioritize and Intensify Leadership Engagement: Organizations must move beyond verbal commitments to safety. Senior and mid-level leaders should be actively measured and held accountable for visible safety leadership actions, such as conducting regular safety walks, personally reviewing incident reports, and allocating resources to address systemic risks identified by the SMS. Leadership training should focus on translating SMS requirements into daily leadership practices.

2. Formalize and Empower Employee Participation: SMS frameworks should be used to institutionalize meaningful worker involvement. This can be achieved by establishing and resourcing cross-functional safety committees with decision-making power, integrating employee representatives into risk assessment and incident investigation teams, and creating transparent channels for reporting and feedback that are free from fear of reprisal.

3. Focus the System on Proactive Risk Management: The primary cultural value of an SMS lies in its ability to prevent harm. Organizations should continually refine their SMS to enhance the quality and scope of proactive risk assessments, encouraging the reporting and investigation of near-misses and

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leading indicators. Resources should be shifted from purely reactive measures towards upstream hazard control and predictive analysis.

4. Revitalize Bureaucratic Components for Cultural Impact: To prevent components like Documentation, Management Review, and Performance Monitoring from becoming inert, they must be explicitly linked to the core cultural drivers. For example, management review meetings should primarily focus on the status of employee-raised concerns and the effectiveness of leadership safety activities. Performance metrics should include cultural indicators (e.g., survey scores, participation rates) alongside lagging indicators.

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