



International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 07, July 2026)

Synergizing Safety and Quality Management: A Strategic Framework for the Integration of QMS and SMS into an Integrated Management System (IMS)

Reyven P. Culis¹, Bernardo F. Firme², Aaron Linus N. Rosete³, Patrick F. Runas⁴, Quinnie Rose G. Sanchez⁵

^{1,2,3,4,5}University of Perpetual Help System Laguna, City of Biñan, Laguna, Philippines

Abstract— Organizations increasingly rely on standardized management systems to improve quality, safety, compliance, and operational stability. Yet in many organizations, Quality Management Systems (QMS) and Safety Management Systems (SMS) are still implemented and audited as parallel structures, creating duplicated procedures, fragmented risk controls, and avoidable administrative burden. This paper develops a strategic framework for integrating QMS and SMS into a single Integrated Management System (IMS) anchored in Industrial Engineering, ISO 9001:2015, ISO 45001:2018, risk-based thinking, and the Plan–Do–Check–Act cycle. A developmental research design was adopted using an integrative literature review of recent studies and institutional reports published from 2022 to 2025, followed by thematic synthesis and framework construction. The review shows that recent scholarship consistently links integrated or aligned management systems with better process coherence, reduced duplication, stronger risk visibility, improved productivity, and stronger organizational performance, while also identifying recurring barriers related to leadership commitment, change management, document harmonization, and systems maturity. In response, the paper proposes a five-phase IMS framework covering strategic diagnosis, policy and process alignment, integrated risk and control design, deployment and capability building, and performance review with continuous improvement. The study contributes a technically grounded, implementation-oriented model that can be used by Management Engineering professionals, ISO practitioners, public agencies, and industrial organizations seeking to institutionalize quality and safety as one coordinated management architecture rather than as separate compliance silos.

Keywords— integrated management system, quality management system, safety management system, ISO 9001, ISO 45001

I. INTRODUCTION

Workplace safety losses and quality failures remain major operational and societal problems. The International Labour Organization reported in 2023 that nearly three million workers die each year due to work-related accidents and diseases, while 395 million workers sustain non-fatal occupational injuries worldwide, underscoring the persistent burden of unsafe work systems and weak

preventive controls (International Labour Organization [ILO], 2023a). The same ILO release notes that agriculture, construction, forestry, fishing, and manufacturing remain among the most hazardous sectors globally, with fatal injury burdens concentrated in labor-intensive and risk-exposed operations (ILO, 2023a). In parallel, the global diffusion of management-system standards continues to grow, and ISO's management-system architecture remains one of the most widely adopted organizational infrastructures for process discipline and assurance (International Organization for Standardization [ISO], 2026). At the firm level, recent reviews show that ISO 9001 certification is still associated with process discipline and organizational performance outcomes, while ISO 45001 adoption is increasingly linked with productivity and profitability gains, indicating that quality and safety are not peripheral administrative functions but central operational drivers (Ayyadi & Oulhadj, 2024; Podrecca et al., 2024).

The Philippine context reinforces the need for an integrated approach. A recent national situational analysis reported that occupational injuries and diseases across Philippine industries remain substantial, with superficial injuries and open wounds accounting for 56.47% of reported injuries and work-related musculoskeletal diseases accounting for 61.82% of reported occupational diseases in the reviewed datasets (Conda et al., 2025). The ILO's National Occupational Safety and Health Profile for the Philippines highlights continuing institutional gaps in reporting, compliance, surveillance, and OSH capability across establishments, even after the enactment of Republic Act No. 11058 and related reforms (ILO, 2024). For organizations operating in manufacturing, construction, logistics, utilities, and public-sector service systems, these data suggest that quality losses, unsafe work conditions, and fragmented compliance structures often stem from the same root causes: weak process standardization, poor feedback loops, incomplete risk visibility, and inconsistent leadership control. Consequently, the move from parallel systems toward a coherent Integrated Management System is not merely a documentation exercise but a systems-engineering response to recurring failures in process governance.



This study benefits several stakeholder groups in the present tense because the proposed framework is designed for immediate institutional application. Organizations benefit from a more economical management architecture that consolidates policies, audits, performance indicators, corrective action systems, and leadership reviews. Government agencies and regulators benefit because an integrated framework improves traceability, consistency of evidence, and the quality of compliance documentation across quality and occupational safety obligations. Management Engineering practitioners benefit because IMS design directly uses systems thinking, process mapping, standardization, capability analysis, risk integration, and continuous-improvement logic that are central to the discipline. The academe benefits because the paper connects ISO-based management architecture with Industrial Engineering theory and provides a contemporary basis for research, teaching, and framework validation. Policymakers likewise benefit because the paper clarifies how annex-based harmonization and process integration can reduce compliance fatigue while improving organizational control.

A clear research gap remains. Recent literature confirms that integrated management systems are increasingly discussed in relation to Annex SL, risk-based thinking, and organizational performance, yet the literature still concentrates heavily on QMS–EMS or broader multi-standard integration, with less direct attention to a technically specified QMS–SMS integration pathway centered on ISO 9001 and ISO 45001 (Francisco et al., 2024; Ispas et al., 2023; Chountalas & Lagodimos, 2024). Studies also show that organizations often understand the benefits of integration in principle but continue to struggle with how to align policy structures, process ownership, risk registers, documentation logic, audit criteria, and review mechanisms in practice (Barbosa et al., 2023; Wang & Liu, 2023). Moreover, the literature still provides limited guidance on how Management Engineering tools can be embedded in IMS design to convert integration from a compliance initiative into a measurable performance system. This gap motivates the present paper to move beyond general advocacy and toward a practical strategic framework for implementation.

Accordingly, the objectives of this paper are to: (1) synthesize recent evidence on QMS, SMS, and IMS implementation from 2022 to 2025; (2) identify the principal technical, organizational, and managerial mechanisms that enable or hinder QMS–SMS integration; and (3) develop a strategic IMS framework suitable for Management Engineering, ISO implementation, and organizational systems integration applications.

The paper addresses the following research questions: What recent evidence explains the need to integrate QMS and SMS? What mechanisms and barriers determine successful integration? What strategic framework can guide organizations in integrating quality and safety into a single IMS? The study is limited to literature and institutional sources published from 2022 onward, with primary emphasis on ISO 9001, ISO 45001, IMS design, risk-based thinking, and organizational performance. It does not claim original field-survey results; instead, it offers a developmental, evidence-synthesized framework intended for subsequent empirical validation.

II. REVIEW OF RELATED LITERATURE

An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

A. Integrated management systems and Annex SL

Recent IMS scholarship emphasizes that standard harmonization is one of the strongest institutional enablers of management-system integration. Francisco et al. (2024) explain that Annex SL provides a common high-level structure that improves compatibility among certifiable management standards and enables organizations to align context analysis, leadership provisions, planning requirements, support clauses, operational controls, performance evaluation, and improvement mechanisms. Their case-based work also shows that many firms still lack the expertise required to adapt older or separately designed systems to the integrated logic of Annex SL, especially when documentation has evolved historically in silos. Similarly, Chountalas and Lagodimos (2024) show through content and bibliometric analysis that IMS research has grown substantially, but the field still lacks strong convergence on implementation models capable of translating integration theory into sector-specific managerial routines.

Ispas et al. (2023) deepen this discussion by showing that risk-based thinking is not merely an add-on to IMS but one of its central integration mechanisms. When systems are implemented separately, risks tend to be evaluated from isolated perspectives; when they are integrated, organizations are forced to assess the synergetic effects of risk across quality, environment, and occupational safety domains. This is particularly important for quality–safety integration because a process failure can simultaneously generate nonconformities, rework, injury exposure, regulatory liability, and service interruptions.

The same authors argue that Annex SL facilitates alignment by embedding PDCA logic and risk-based thinking across standards, thereby creating a common language for integrated planning and control. In 2025, Ispas et al. further highlighted emergence and resilience as important properties of IMS, arguing that properly integrated systems help industrial organizations absorb turbulence and sustain coordinated performance under disruption (Ispas et al., 2025).

B. Quality management and organizational performance

Recent evidence continues to support the strategic relevance of quality-management systems. Ayyadi and Oulhadj (2024), in a systematic literature review on ISO 9001 certification and organizational performance among manufacturing companies, found that the literature consistently associates QMS adoption with stronger process consistency, documentation discipline, customer-focus mechanisms, and performance visibility. Although outcomes vary by context and maturity, the review reinforces the view that ISO 9001 functions best when it becomes a management architecture for process control and learning rather than a symbolic certification exercise. Hernandez-Vivanco and Bernardo (2023) add that management systems can influence productive efficiency across the certification life-cycle, implying that benefits are dynamic and related to how organizations maintain and use their systems after certification, not merely whether they are certified.

From a Management Engineering standpoint, the significance of QMS lies in its ability to formalize process design, establish measurable controls, and reduce hidden quality costs through standardization, preventive action, and feedback. These features are highly compatible with Industrial Engineering methods such as process mapping, standard work design, cause-and-effect analysis, statistical process control, and capability improvement. Recent work on quality management and digital transformation also suggests that QMS increasingly operates as an information-rich system that can support traceability, analytics, and data-driven improvement when integrated with other organizational controls. This makes QMS a strong backbone for integration with SMS, because many of the same processes that govern defect prevention and conformity also determine safe operating conditions.

C. Safety management systems and organizational performance

The recent safety-management literature shows that occupational safety systems create both human and operational value.

Podrecca et al. (2024) found that ISO 45001-certified companies outperformed non-adopters in productivity and profitability, suggesting that safety certification can contribute to stronger business results rather than merely additional compliance cost. Chatzoglou (2025) similarly reported that an effective health and safety management system, structured around PDCA and safety-culture factors, can improve employee satisfaction and employee performance. In a Saudi context, Aichouni et al. (2023) identified a positive relationship between total quality management practices and occupational safety and health performance, while Alghaseb and Alshmlani (2022) found that OSH performance is strengthened when construction organizations adopt TQM-aligned practices. These findings are especially relevant to QMS–SMS integration because they demonstrate that quality-oriented managerial disciplines and safety outcomes are interdependent rather than separate.

Recent OSH scholarship in the Philippines likewise supports the need for stronger systemization. Conda et al. (2025) show that injury and disease patterns still require better preventive and control measures, while the national OSH profile developed with ILO support points to continuing needs in surveillance, reporting, and institutional capacity (ILO, 2024). For Management Engineering, this means that safety cannot be managed solely through inspections or reactive incident analysis. It must be embedded into process design, work methods, resource planning, competence systems, and performance dashboards. ISO 45001 supports that approach because it requires the organization to identify hazards, assess risks, establish controls, determine legal and other requirements, and evaluate performance systematically. These are precisely the kinds of structured management activities that lend themselves to integration with a mature QMS.

D. Integrated systems, performance, and strategic integration

Studies directly examining IMS and organizational outcomes provide a strong rationale for integration. Barbosa et al. (2023) developed a multidimensional perspective on IMS and organizational performance and showed that workers perceive integrated management systems through interrelated quality, environmental, and occupational-health-and-safety dimensions. Their results suggest that performance gains from IMS are best understood as multidimensional rather than single-metric outcomes. Wang and Liu (2023) further demonstrated that the relationship between IMS and firm performance depends partly on integration strategy, indicating that the sequence and logic of implementation matter.

This is a crucial insight for organizations planning to integrate QMS and SMS: the issue is not only whether integration is desirable, but how the integration pathway is designed, governed, and sustained.

Marhavilas et al. (2022) argue that effective OSH-related IMS must merge multiple management systems, including quality and environmental systems, and identify barriers such as implementation cost, employee resistance, and the complexity of combining standards. Al-Maaitah and Aljbour (2022) likewise found that quality-management dimensions such as training, teamwork, leadership, recognition, and ethics affect OSH outcomes in industrial laboratories, reinforcing the operational overlap between quality and safety. Taken together, the recent literature supports three major propositions. First, integration reduces duplicated routines and creates management coherence. Second, integration works best when risk management, documentation, leadership, and review processes are redesigned rather than merely merged administratively. Third, the technical success of integration depends on disciplined implementation mechanisms, which is why a strategic framework grounded in Management Engineering is needed.

TABLE I
SELECTED RECENT LITERATURE INFORMING THE QMS–SMS
INTEGRATION FRAMEWORK

Study	Focus	Method / Context	Key implication for the present paper
Ayyadi & Oulhadj (2024)	ISO 9001 and organizational performance	Systematic literature review	Supports the use of QMS as a performance-enabling architecture, not only as a certification label.
Podrecca et al. (2024)	ISO 45001 and firm performance	Large-scale empirical analysis	Shows that OH&S certification can be associated with productivity and profitability gains.
Francisco et al. (2024)	IMS adaptation to Annex SL	Multiple case studies in industry	Explains why high-level structure and integration leadership are central to successful IMS redesign.
Ispas et al. (2023)	Risk-based IMS implementation	Systematic literature review	Positions risk-based thinking as the technical bridge between

			separate management domains.
Barbosa et al. (2023)	IMS and organizational performance	Questionnaire, FA, and SEM	Demonstrates that IMS effects should be interpreted as multidimensional organizational outcomes.
Wang & Liu (2023)	IMS–performance relationship	Empirical operations-management study	Shows that integration strategy influences performance outcomes.
Marhavilas et al. (2022)	IMS standards related to OSH	Updated literature survey	Identifies barriers and supports integration of quality and safety standards.
Conda et al. (2025)	OSH landscape in the Philippines	National situational analysis	Provides local evidence that OSH problems remain substantial and system-level responses are needed.
Hernandez-Vivanco & Bernardo (2023)	Certification and efficiency	Productive-efficiency analysis	Suggests that system benefits depend on how standards are maintained throughout the certification life-cycle.
Al-Maaitah & Aljbour (2022)	QMS effects on OSH	Questionnaire-based study in laboratories	Shows that quality-management dimensions influence occupational safety outcomes.

A. Conceptual Framework

The proposed framework treats QMS practices and SMS practices as the primary independent variable groups and explains how their integration influences three dependent outcome groups: organizational performance, safety compliance, and quality outcomes. The framework is grounded in systems thinking and the ISO high-level structure. It assumes that integration creates value through three primary mechanisms: process alignment, risk-based thinking, and continuous improvement through PDCA.

In practical terms, this means that policy deployment, standard operating procedures, controls, competence systems, monitoring arrangements, audits, and reviews are designed as a connected management architecture rather than as two separate compliance systems.

Integrated Management System (IMS) Conceptual Framework

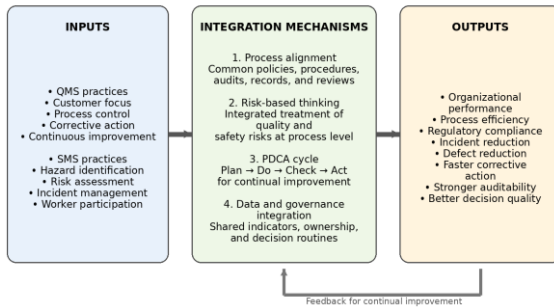


FIGURE 1 CONCEPTUAL FRAMEWORK FOR INTEGRATING QMS AND SMS INTO AN INTEGRATED MANAGEMENT SYSTEM

Independent variables. QMS practices include process control, corrective action, customer focus, and continual improvement. SMS practices include hazard identification, risk assessment, incident management, worker participation, and legal-compliance control.

Dependent variables. The integrated system is expected to improve organizational performance (efficiency, responsiveness, productivity), safety compliance (hazard control, incident prevention, legal conformity), and quality outcomes (defect reduction, consistency, complaint reduction, rework reduction).

Integration mechanisms. Process alignment reduces duplicated procedures and clarifies process ownership. Risk-based thinking unifies quality and safety risk treatment at the process level. The PDCA cycle establishes a common improvement engine that uses findings, incidents, nonconformities, and audits as inputs for redesign.

PDCA-Based Integration Logic for QMS and SMS

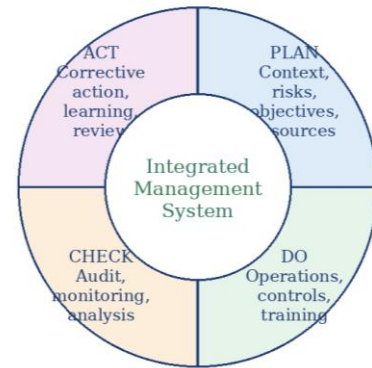


FIGURE 2 PDCA-BASED INTEGRATION LOGIC LINKING QUALITY AND SAFETY CONTROLS

Figure 2 shows how planning integrates organizational context, interested parties, legal and customer requirements, objectives, and risk planning; doing integrates operational controls, competence, communication, and support processes; checking integrates audits, monitoring, incident and nonconformity analysis, and management review; acting integrates corrective action, learning, redesign, and standardization.

TABLE 2
OPERATIONAL DEFINITION OF VARIABLES AND ILLUSTRATIVE INDICATORS FOR THE INTEGRATED MANAGEMENT SYSTEM (IMS) FRAMEWORK

Construct	Operational meaning in the framework	Illustrative indicators
QMS practices	Formal quality-management routines that stabilize process outputs and customer conformity.	Document control, process KPI use, CAPA closure, defect prevention, audit conformance
SMS practices	Formal occupational safety and health controls intended to identify, assess, and reduce workplace hazards.	Hazard identification, risk controls, legal registers, incident learning, participation
Integration mechanisms	Shared managerial processes through	Common procedures, shared risk register,

	which QMS and SMS are combined into one operating system.	unified review, integrated training, combined audits
Organizational performance	Operational effects associated with a well-functioning integrated system.	Cycle-time reliability, productivity, reduced duplication, lower waste, better coordination
Safety compliance	Conformity with legal, regulatory, and internal safety obligations.	Inspection readiness, closure of OSH findings, training compliance, incident reduction
Quality outcomes	Performance results associated with process and service quality.	Defect reduction, customer complaints, rework levels, process capability

III. METHODOLOGY

This paper uses a developmental research design supported by an integrative literature review and framework-synthesis approach. The choice of method is appropriate because the goal of the study is to develop a strategic framework for QMS–SMS integration rather than to report primary field data. In Management Engineering terms, the paper follows a systems-design logic: it identifies the problem context, analyzes recent evidence, extracts recurring constructs and mechanisms, and synthesizes them into an implementation model capable of guiding organizational practice.

Source identification focused on publications and institutional materials from 2022 to 2025. Searches targeted recent work on integrated management systems, ISO 9001, ISO 45001, occupational safety and health management, Annex SL, risk-based thinking, and organizational performance. Priority was given to peer-reviewed journal articles, systematic reviews, empirical studies, and institutional reports with direct relevance to QMS–SMS integration. The resulting evidence base combined recent journal sources with authoritative international and Philippine OSH references to ensure that both global and local contexts were addressed.

Inclusion criteria covered studies published from 2022 onward; explicit relevance to quality management, safety management, integrated management systems, or management-system performance; and sufficient methodological or conceptual detail to support framework development.

Exclusion criteria covered sources that were outdated relative to the requested time horizon, weakly related to QMS–SMS integration, or lacking sufficient transparency about their contribution. Each retained source was coded for publication year, domain focus, methodological orientation, major constructs, integration mechanisms, key benefits, key barriers, and implications for framework design.

The synthesis process followed four analytical stages. First, source screening and classification were conducted to organize the evidence according to quality, safety, integration, and performance themes. Second, open coding was used to identify recurring concepts such as leadership commitment, process alignment, documentation consolidation, integrated auditing, worker participation, risk visibility, and continuous improvement. Third, axial coding grouped these concepts into higher-order design dimensions relevant to a QMS–SMS integration model. Fourth, the extracted dimensions were translated into a strategic framework composed of phases, enabling mechanisms, and expected outcomes. This procedure is consistent with developmental and design-oriented research in operations and systems management, where synthesis is used to build implementable frameworks from fragmented evidence.

Because the present paper is literature-based, no human subjects were recruited and no organizationally confidential primary data were collected. Nevertheless, the paper specifies a rigorous validation path for future empirical use. A subsequent field-based study may operationalize the framework using survey instruments for process alignment, integrated risk management, leadership commitment, training adequacy, integrated documentation quality, and performance-review maturity. The same follow-up study may also incorporate structured interviews, document audits, and process observations to triangulate results. In this sense, the present paper offers both an immediately usable integration framework and a research design foundation for empirical testing in Management Engineering environments.

Statistical Validation Model for Future Empirical Testing

For future empirical validation, the following constructs may be measured quantitatively: QMS maturity, SMS maturity, integration intensity, process standardization, integrated risk management, leadership commitment, employee competence, quality outcomes, safety outcomes, and overall organizational performance. Responses may be collected using a five-point or seven-point Likert scale and supplemented with objective indicators such as defect rate, near-miss frequency, incident rate, nonconformity closure time, training compliance, and audit findings.

Recommended descriptive statistics include the weighted mean and standard deviation. For a set of responses X , the arithmetic mean is represented as $\bar{X} = \Sigma X / n$, while dispersion may be estimated using $SD = \sqrt{[\Sigma(X - \bar{X})^2 / (n - 1)]}$. Reliability testing should include Cronbach's alpha for multi-item constructs, and exploratory or confirmatory factor analysis may be used to verify dimensionality. Where sample size allows, the Kaiser–Meyer–Olkin test and Bartlett's test of sphericity should be reported before factor extraction.

To examine relationships among constructs, Pearson's correlation coefficient may be used: $r = \Sigma[(X_i - \bar{X})(Y_i - \bar{Y})] / \sqrt{[\Sigma(X_i - \bar{X})^2 \Sigma(Y_i - \bar{Y})^2]}$. Multiple regression may then be used to estimate the effect of QMS practices, SMS practices, and integration mechanisms on organizational performance, quality outcomes, and safety compliance. A general model may be stated as $Y = \beta_0 + \beta_1 X_{QMS} + \beta_2 X_{SMS} + \beta_3 X_{INT} + \epsilon$, where Y is a dependent performance construct, X_{QMS} represents QMS maturity, X_{SMS} represents SMS maturity, and X_{INT} represents integration intensity. If a more advanced validation is desired, structural equation modeling may be used to test direct, indirect, and mediating relationships among integration constructs.

Industrial Engineering tools may complement statistical analysis. SIPOC, value-stream mapping, swimlane process mapping, cause-and-effect analysis, FMEA, Pareto analysis, and control charts are useful for diagnosing where quality and safety controls overlap or conflict. Process capability indices such as C_p and C_{pk} can be used when measurable process characteristics are available, while risk-priority ratings and corrective-action cycle-time analysis can support control-phase decisions. These tools make the framework operationally actionable rather than purely conceptual.

TABLE 3
ILLUSTRATIVE STATISTICAL TOOLKIT FOR FUTURE VALIDATION OF THE FRAMEWORK

Technique	Formula / Model	Purpose
Mean	$\bar{X} = \Sigma X / n$	Describes the central tendency of integration ratings or maturity scores.
Standard deviation	$SD = \sqrt{[\Sigma(X - \bar{X})^2 / (n - 1)]}$	Describes dispersion or consistency of responses across respondents or units.
Pearson correlation	$r = \Sigma[(X_i - \bar{X})(Y_i - \bar{Y})] / \sqrt{[\Sigma(X_i - \bar{X})^2 \Sigma(Y_i - \bar{Y})^2]}$	Tests the strength and direction of association between integration constructs and outcomes.
Multiple regression	$Y = \beta_0 + \beta_1 X_{QMS} + \beta_2 X_{SMS} + \beta_3 X_{INT} + \epsilon$	Estimates the effect of QMS, SMS, and integration intensity on performance outcomes.

IV. RESULTS AND DISCUSSION

The synthesis reveals five recurring propositions from the recent literature. First, QMS and SMS share a large number of structurally compatible management requirements. These include policy setting, objective deployment, competence management, documented information control, operational planning, monitoring and measurement, internal audit, management review, corrective action, and continual improvement. Annex SL reduces the conceptual distance between standards by normalizing clause architecture and language, making formal integration significantly more feasible than in earlier generations of standards (Francisco et al., 2024; Ispas et al., 2023).

Second, integration produces value primarily by reducing duplication and improving management coherence. The literature consistently links IMS with fewer parallel procedures, less repetitive documentation, better coordination of audits and reviews, improved traceability of actions, and stronger visibility of cross-functional risks (Barbosa et al., 2023; Chountalas & Lagodimos, 2024). In Management Engineering terms, integration reduces non-value-adding administrative motion and overprocessing in the governance system. Separate systems often require repeated meetings, repeated document revisions, repeated training records, repeated audits, and repeated corrective-action channels. Integration allows these to be redesigned as a single process architecture.

Third, leadership and implementation strategy are decisive. Wang and Liu (2023) show that performance effects vary according to integration strategy, while Francisco et al. (2024) highlight the importance of integration leadership, cultural readiness, and capability for adapting legacy systems to Annex SL. The evidence suggests that organizations fail when they treat IMS as a clerical merger of manuals rather than a redesign of management logic. Leadership must therefore clarify ownership, resolve priority conflicts between quality and safety objectives, and define how integrated decisions will be made at process, departmental, and executive levels.

Fourth, risk-based thinking is the core technical bridge between QMS and SMS. Quality risks and safety risks often originate in the same processes: poor maintenance, weak standard work, inadequate training, poor supervision, inadequate change control, and poor communication can simultaneously create defects, delays, and unsafe conditions. Ispas et al. (2023) argue that integrated systems require recognition of these synergetic effects rather than isolated risk treatment.

This insight is highly relevant for Industrial Engineering because it supports integrated risk registers, shared process failure modes, common escalation criteria, and unified preventive-action design. It also supports the use of FMEA and root-cause analysis across both quality and safety events.

Fifth, recent empirical evidence supports the claim that management systems can influence business performance when implemented seriously. ISO 45001 adoption has been associated with better productivity and profitability (Podrecca et al., 2024), ISO 9001 remains associated with stronger organizational performance and process discipline (Ayyadi & Oulhadj, 2024), and integrated systems have been linked to multidimensional organizational-performance benefits (Barbosa et al., 2023). The implication is that an IMS should not be evaluated only by certification status. It should be evaluated by its effect on defect prevention, incident reduction, process reliability, responsiveness, compliance quality, employee capability, and decision speed.

TABLE 4
SYNTHESIZED FINDINGS AND MANAGEMENT-ENGINEERING INTERPRETATION

Synthesized finding	Implication for QMS–SMS integration	Management Engineering interpretation
Annex SL and clause compatibility make formal integration feasible.	Organizations can redesign core procedures under one architecture instead of maintaining parallel manuals.	This reduces administrative overprocessing and improves process standardization.
Risk-based thinking links quality failures and safety hazards.	Integrated risk registers and shared control plans become possible and preferable.	FMEA, hazard analysis, and root-cause analysis can be deployed across both domains.
Leadership and integration strategy affect results.	Integration requires governance, ownership, sequencing, and change management.	System success depends on design choices, not on certification status alone.
IMS improves multidimensional performance rather than a single metric.	Evaluation should include safety, quality, compliance, efficiency, and learning indicators.	Balanced KPI systems and dashboard review are essential.
Training and participation are recurrent enablers.	Frontline users must understand the new architecture and contribute to its refinement.	Capability building is a necessary condition for sustainable process control.

A. Strategic Framework for Implementation

Based on the synthesis, this paper proposes a five-phase strategic framework for QMS–SMS integration.

Strategic Roadmap for QMS–SMS Integration

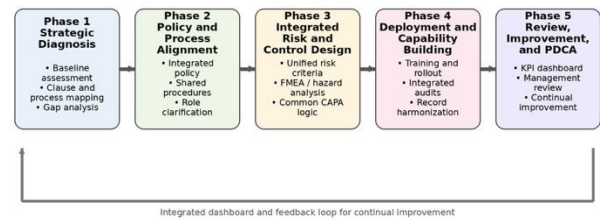


FIGURE 3 FIVE-PHASE STRATEGIC ROADMAP FOR INTEGRATING QMS AND SMS INTO AN IMS

Phase 1 is Strategic Diagnosis: The organization determines the current maturity of its QMS and SMS, identifies duplicated procedures and records, reviews stakeholder and regulatory requirements, and maps process interfaces where quality and safety controls overlap. This phase should use process mapping, clause-to-clause comparison, risk-register review, and maturity assessment to establish the baseline. Without this diagnosis, organizations risk integrating documents without integrating operational controls.

Phase 2 is Policy and Process Alignment: Here, the organization develops an integrated management policy, aligns objectives, rationalizes roles and responsibilities, and harmonizes core procedures such as document control, competence management, operational planning, communication, change management, emergency preparedness, nonconformity handling, and management review. The goal is not to erase the distinct purposes of quality and safety, but to govern them through a single process architecture with clear linkages, owners, and escalation rules.

Phase 3 is Integrated Risk and Control Design: This phase establishes a unified approach to identifying process risks, hazards, operational controls, monitoring points, and response actions. Process FMEA, hazard analysis, legal-requirement registers, quality-control plans, and operational work instructions should be redesigned as connected control mechanisms. In Management Engineering terms, this is where system design becomes technically meaningful, because it converts integration into engineered controls rather than textual consolidation. The output of this phase includes integrated risk criteria, shared control plans, and common corrective/preventive-action pathways.

Phase 4 is Deployment and Capability Building: Integration succeeds only when personnel understand how the new architecture changes their work. This phase covers communication, training, pilot testing, integrated internal auditing, document rollout, supervisor coaching, and digital record harmonization. It also requires worker participation because frontline employees are often the first to experience whether integrated controls are realistic, conflicting, or overdesigned. A recurring lesson from the literature is that competence, participation, and leadership support are necessary for integration to move from paper to practice (Chatzoglou, 2025; Marhavalas et al., 2022).

Phase 5 is Performance Review and Continual Improvement: The integrated system is reviewed using a unified dashboard that includes quality, safety, compliance, process, and capability indicators. Typical measures may include incident rate, near-miss closure time, training compliance, audit finding recurrence, process defect rate, customer complaints, rework cost, and corrective-action aging. Management review should analyze these indicators together rather than separately to detect interactions between productivity, conformity, and safety. The output of this phase is a continual-improvement loop governed by PDCA, where lessons from audits, incidents, nonconformities, and stakeholder feedback are translated into integrated system redesign.

TABLE 5
EXAMPLE IMS CONTROL POINTS FOR ORGANIZATIONAL APPLICATION

Control area	Typical integrated design decision	Primary evidence generated	Expected effect
Documented information	One document-control process for QMS and SMS records, revisions, approvals, and retention.	Master list, revision history, document approval trail	Lower duplication and stronger traceability
Operational planning	One process map that identifies both quality controls and safety controls per activity.	Integrated SOPs, work instructions, control plans	More consistent execution and fewer control conflicts
Competence and training	Shared competence matrix for process, quality, and safety requirements.	Training records, competence evaluations, authorization matrix	Improved capability and lower error exposure

Control area	Typical integrated design decision	Primary evidence generated	Expected effect
Internal audit	Integrated audit checklist covering quality, safety, process, and risk requirements.	Combined audit reports and follow-up actions	Reduced audit fatigue and broader systems insight
Corrective action	Single nonconformity/incident system with common root-cause and closure logic.	CAPA log, 5-Why/Fishbone outputs, closure verification	Faster learning and lower recurrence
Management review	Unified review of KPIs, risks, actions, compliance, and improvement priorities.	Review minutes, dashboard, strategic action log	Stronger executive control and better prioritization

B. Theoretical Foundations of the Proposed Framework

Although the framework is synthesized inductively from recent empirical evidence, its integration logic rests on an established body of organizational and engineering theory. Making these theoretical anchors explicit strengthens the conceptual validity of the model and clarifies why the integration of quality and safety management is expected to generate the proposed outcomes rather than merely consolidate documentation. Five complementary theories provide this foundation: Systems Theory, Socio-Technical Systems Theory, Continuous Improvement Theory, Total Quality Management Theory, and High Reliability Organization Theory. Together they justify the framework's treatment of quality and safety as interdependent subsystems governed through a single, learning-oriented management architecture.

Systems Theory: Systems Theory holds that an organization is a set of interrelated components whose collective behavior cannot be understood by examining each part in isolation. This principle directly justifies the central premise of the framework, namely that QMS and SMS should not be governed as separate compliance silos but as subsystems of one organizational system. Because a single process failure can simultaneously generate nonconformities, rework, and unsafe conditions, the boundaries between quality and safety are analytically artificial.



Systems Theory therefore supports the framework's emphasis on process interfaces, shared inputs and outputs, and the management of emergent, system-level properties that arise only when the two domains are coordinated. It supplies the rationale for Phase 1 (Strategic Diagnosis), in which process interfaces and cross-domain interactions are mapped before any documentation is consolidated.

Socio-Technical Systems Theory: Socio-Technical Systems Theory argues that organizational performance is optimized only when the technical subsystem (processes, technology, procedures, and controls) and the social subsystem (people, competence, participation, and culture) are jointly designed rather than optimized independently. This theory underpins the framework's insistence that integration is not a clerical merger of manuals but a redesign of both work systems and human roles. It justifies the prominence given to worker participation, competence development, and leadership commitment in Phases 2 and 4, and it explains why integration efforts that address only the technical documentation while neglecting the social subsystem tend to fail. The joint-optimization principle provides theoretical grounding for the framework's shared competence matrices, integrated training, and frontline involvement in control design.

Continuous Improvement Theory: Continuous Improvement Theory, expressed operationally through the Plan-Do-Check-Act (PDCA) cycle, conceptualizes management as an iterative process of planning, execution, evaluation, and adjustment. This theory is the explicit engine of the proposed model: the framework uses audits, incidents, nonconformities, and stakeholder feedback as shared inputs to a single improvement loop rather than two parallel ones. Continuous Improvement Theory justifies Phase 5 (Performance Review and Continual Improvement) and explains why the framework treats integration as a dynamic, maturing capability rather than a static end state. It also reinforces the literature's finding that the benefits of management systems depend on how they are maintained and used over the certification life-cycle, not merely on whether certification is obtained.

Total Quality Management (TQM) Theory: TQM Theory emphasizes leadership, customer focus, process orientation, employee involvement, fact-based decision making, and a pervasive culture of quality across the organization. Its relevance to the framework is twofold. First, empirical work cited in this study demonstrates that TQM-aligned practices are positively associated with occupational safety and health performance, indicating that the managerial disciplines that produce quality also produce safety.

Second, TQM provides the cultural and leadership logic that the framework operationalizes through integrated policy, management commitment, and unified review. TQM therefore supports the framework's claim that quality and safety are coordinated design variables governed by common managerial principles, and it justifies the integration mechanisms that link process control, participation, and continuous learning across both domains.

High Reliability Organization (HRO) Theory: HRO Theory examines how organizations operating in hazardous, complex environments sustain near error-free performance through preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience, and deference to expertise. This theory is particularly relevant to the safety dimension of the framework and to its risk-based integration logic. HRO principles justify the framework's emphasis on integrated risk registers, shared failure-mode analysis, and the treatment of near-misses and nonconformities as early signals of systemic weakness. They also reinforce the property of resilience identified in recent IMS scholarship, supporting the framework's expectation that an integrated system helps organizations absorb disruption and sustain coordinated performance. HRO Theory thereby strengthens the conceptual justification for Phase 3 (Integrated Risk and Control Design).

Collectively, these theories establish that the framework is not an ad hoc procedural template but a theoretically grounded model. Systems Theory and Socio-Technical Systems Theory justify the structural logic of integration; Continuous Improvement Theory and TQM Theory justify its managerial and cultural engine; and HRO Theory justifies its risk and reliability orientation. Each theory links directly to the study objectives of synthesizing integration evidence, identifying enabling and hindering mechanisms, and developing an implementable strategic framework, thereby providing a coherent conceptual scaffold for the five-phase model.

C. Theoretical and Practical Contribution of the Proposed Framework

Beyond synthesizing existing evidence, the proposed framework makes distinct theoretical and practical contributions that position it as a meaningful addition to integrated management systems scholarship and to Industrial and Management Engineering practice. These contributions are articulated below to clarify the originality and applied relevance of the model.



Theoretical Contributions: The framework advances the literature first through its novel integration logic. Whereas much prior work treats integration as the administrative harmonization of clauses under Annex SL, the present model reframes integration as the engineered coupling of quality and safety controls at the process level, mediated explicitly by risk-based thinking and PDCA. This logic moves the discourse from documentation alignment toward control-system design, offering a more technically specified account of how integration produces value. By foregrounding shared failure modes, common control plans, and unified corrective-action pathways, the framework contributes a mechanism-based explanation of integration that complements the largely outcome-focused empirical literature.

Second, the framework advances Integrated Management Systems (IMS) literature by addressing a specific and underdeveloped pathway. Existing IMS scholarship concentrates heavily on QMS–EMS combinations or broad multi-standard integration, with comparatively limited attention to a technically specified QMS–SMS pathway centered on ISO 9001 and ISO 45001. The framework narrows this gap by providing a focused, standard-aligned model for quality–safety integration, thereby extending IMS theory into a domain where the operational interdependence between defect prevention and hazard control is especially strong.

Third, the framework contributes to Industrial Engineering knowledge by embedding discipline-specific tools—process mapping, SIPOC, value-stream analysis, FMEA, root-cause analysis, statistical process control, and process-capability assessment—within the architecture of management-system integration. In doing so, it demonstrates how Industrial Engineering method can convert integration from a compliance initiative into a measurable performance system, reinforcing the discipline’s claim to systems-level governance problems rather than purely technical optimization tasks.

Fourth, the framework contributes to management systems integration research by making its theoretical foundations explicit and by linking five complementary theories to concrete framework components. This theoretical scaffolding responds to the recurring observation that IMS research lacks convergence on implementation models capable of translating integration theory into sector-specific routines. By connecting Systems, Socio-Technical, Continuous Improvement, TQM, and HRO theories to identifiable phases and mechanisms, the framework offers a more theoretically integrated account than procedurally oriented models typically provide.

Practical Contributions: On the practical side, the framework is designed for immediate applicability within Philippine organizations. Given documented gaps in occupational safety reporting, surveillance, and compliance capability across Philippine establishments, and the substantial burden of occupational injuries and diseases reported nationally, the framework offers public agencies, manufacturers, and service providers a structured pathway to consolidate fragmented quality and safety obligations. Its phase-based design accommodates organizations at differing maturity levels, allowing institutions operating under both ISO 9001 and Republic Act No. 11058 requirements to rationalize compliance without abandoning domain-specific expertise.

The framework also offers concrete benefits for manufacturing and service industries. Manufacturing organizations, where quality defects and physical hazards frequently share root causes in maintenance, standard work, and change control, can deploy integrated risk registers and shared control plans to address both simultaneously. Service organizations, where process consistency and worker well-being shape customer experience and regulatory standing, can use the unified documentation and review architecture to reduce administrative duplication while strengthening assurance. In both settings, the model is sector-adaptable rather than prescriptive.

Compared with existing IMS approaches, the framework provides several operational advantages. It replaces parallel audits, manuals, training records, and corrective-action channels with a single coordinated architecture, reducing the non-value-adding administrative motion that fragmented systems impose. It specifies engineered controls rather than textual consolidation, lowering the risk that integration remains superficial. And it embeds a unified performance dashboard that supports the joint interpretation of safety, quality, compliance, and capability indicators, enabling management review to detect interactions that separate systems obscure.

Finally, the framework is positioned to deliver measurable improvements in efficiency, compliance, risk management, and organizational performance. Efficiency gains arise from reduced duplication and clearer process ownership; compliance gains arise from consistent evidence, improved traceability, and integrated audit criteria; risk-management gains arise from shared failure-mode analysis and common escalation logic; and organizational-performance gains arise from the multidimensional improvements—productivity, defect reduction, incident prevention, and decision speed—that the recent empirical literature associates with mature integrated systems.

These anticipated effects are stated as testable propositions that the validation activities described below are intended to confirm.

D. Validation, Pilot Testing, and Empirical Robustness

Because the present study is developmental and literature-based, the framework has not yet undergone field implementation. To meet the empirical expectations of high-quality journals and to establish the model's practical robustness, this subsection specifies a structured validation pathway and explains how each activity would strengthen the framework. These activities are presented as recommended future validation steps; no primary organizational data were collected in the present study.

A pilot test of the framework should precede full-scale deployment. A pilot would apply the five-phase model within a single organizational unit or a small set of representative processes, allowing the integration team to evaluate whether the harmonized procedures, shared risk registers, and integrated controls are realistic, internally consistent, and free of conflicting requirements. Piloting would surface practical obstacles—such as ownership ambiguities, documentation gaps, or control conflicts between quality and safety objectives—before they propagate across the organization. The outcome of a pilot would be a refined framework with empirically adjusted control points and a documented implementation playbook.

Validation through organizational and industry respondents would establish content and construct validity. Subject-matter experts—ISO practitioners, quality and safety managers, and Industrial and Management Engineering professionals—should evaluate the framework using structured instruments that assess relevance, clarity, completeness, and feasibility. A content validity index derived from expert ratings, complemented by structured interviews and a Delphi process where consensus is required, would provide systematic evidence that the framework's phases, mechanisms, and indicators are appropriate and exhaustive for real organizational settings. Respondent validation would also help calibrate the framework to the maturity levels commonly encountered in Philippine manufacturing and service organizations.

Quantitative and statistical validation would test the framework's propositions empirically. As detailed in the methodology, constructs such as QMS maturity, SMS maturity, integration intensity, process standardization, integrated risk management, leadership commitment, and competence can be measured using validated multi-item scales and supplemented with objective indicators such as defect rate, near-miss frequency, incident rate, and nonconformity closure time.

Reliability should be established through Cronbach's alpha, dimensionality verified through exploratory and confirmatory factor analysis, and the hypothesized relationships tested through correlation, multiple regression, and—where sample size permits—structural equation modeling to examine direct, indirect, and mediating effects. Such testing would convert the framework's anticipated benefits from theoretical propositions into empirically supported relationships.

Finally, application of the framework in an actual industry case setting would demonstrate practical robustness under real operating conditions. A longitudinal case implementation—ideally in an organization certified to both ISO 9001 and ISO 45001—would track integration outcomes over time, comparing pre- and post-integration performance on duplication, audit efficiency, incident and defect rates, and compliance quality. Case-based validation would also document context-specific enablers and barriers, providing the kind of situated evidence that allows other organizations to judge the framework's transferability. Collectively, pilot testing, respondent validation, statistical testing, and case application would move the framework from a conceptually rigorous model toward an empirically validated management technology, satisfying the evidentiary standards expected of Scopus-indexed research.

E. Limitations of the Study

While the proposed framework offers a technically grounded and theoretically supported approach to QMS–SMS integration, several limitations must be acknowledged to situate its contribution accurately and to guide its responsible use.

First, the framework has not yet undergone field implementation or validation. It is derived from an integrative synthesis of recent literature and institutional evidence rather than from primary organizational data, so its anticipated effects on efficiency, compliance, risk management, and performance remain propositions to be tested rather than demonstrated outcomes. Until the model is applied in operating organizations, claims about its impact should be interpreted as evidence-informed expectations.

Second, no pilot testing was conducted within the scope of this study. Without a pilot, the practical fit of the harmonized procedures, integrated risk registers, and shared control plans has not been observed under real working conditions, and potential conflicts between quality and safety requirements at the process level have not been empirically surfaced or resolved. Pilot testing is therefore a necessary subsequent step before full-scale adoption.

Third, the study is subject to potential literature-selection bias. The evidence base was deliberately restricted to sources published from 2022 to 2025 and to material directly relevant to QMS, SMS, IMS, and management-system performance. Although this focus ensures currency, it may have excluded older foundational work, grey literature, or relevant studies in languages or databases outside the search scope, which could shape the constructs and mechanisms emphasized in the framework.

Fourth, the framework is conceptual in nature. As a developmental model, it specifies phases, mechanisms, and indicators but does not prescribe organization-specific parameters such as control thresholds, audit frequencies, or resource requirements, which must be calibrated to each context. Its value lies in providing a structured architecture rather than a turnkey implementation.

Fifth, the generalizability of the framework across industries and organizational contexts is presently limited. The model was synthesized with particular attention to manufacturing, service, and public-sector settings and to the Philippine regulatory environment; its transferability to other sectors, regulatory regimes, and cultural contexts has not been established and should not be assumed without adaptation and testing.

Finally, and as a consequence of the limitations above, the framework requires future empirical validation. The pilot testing, respondent validation, statistical testing, and longitudinal case application described earlier are essential to confirm the framework's validity, reliability, and practical robustness. These limitations do not diminish the study's contribution but rather define a clear and necessary agenda for subsequent research.

V. CONCLUSION

The review confirms that the integration of QMS and SMS into an Integrated Management System is both technically feasible and strategically valuable. Recent evidence shows that quality and safety are structurally compatible under Annex SL, operationally interdependent at the process level, and jointly influential on organizational performance. The literature also shows that the benefits of integration do not arise automatically from certification; they depend on deliberate redesign of policies, processes, risk controls, documentation, leadership mechanisms, and review routines.

The study answers the research questions in three ways. First, recent evidence explains the need for QMS–SMS integration through persistent safety losses, continuing quality-related inefficiencies, and the structural compatibility of modern ISO management-system standards.

Second, the principal mechanisms of successful integration are process alignment, integrated risk-based thinking, leadership commitment, competence development, and PDCA-driven review, while the major barriers are siloed ownership, fragmented documentation, cultural resistance, and low systems maturity. Third, the proposed five-phase strategic framework provides a practical model that organizations can use to diagnose, align, design, deploy, and improve an integrated management architecture.

The paper contributes to integrated management systems by offering a focused QMS–SMS model rather than a generic multi-standard integration narrative. It contributes to Management Engineering practice by grounding integration in systems thinking, process architecture, risk integration, standardization, and continuous-improvement logic. It also contributes to organizational performance discourse by positioning quality and safety as coordinated design variables that should be managed together. Future empirical studies may validate the framework in manufacturing firms, government agencies, utilities, higher education institutions, and research organizations that operate under both quality and occupational-safety requirements.

VI. RECOMMENDATIONS

1. Organizations should begin with a structured baseline assessment that compares existing QMS and SMS clauses, process maps, risk registers, audit programs, and records before attempting documentation consolidation.
2. Top management should designate a formal IMS integration owner or steering group with authority across quality, safety, operations, human resources, and compliance functions.
3. Core cross-cutting procedures—such as document control, competence management, change management, corrective action, internal audit, and management review—should be redesigned as shared processes with common owners and inputs.
4. Risk management should be unified through a single methodology that captures both quality failure modes and safety hazards at the process level. Where possible, FMEA or equivalent structured analysis should be used.
5. Organizations should deploy an integrated performance dashboard that includes both lagging and leading indicators for quality, safety, compliance, and capability, and management review should assess them as a connected system.

6. Training programs should emphasize that integration is not the elimination of safety or quality specialization, but the coordination of specialized controls under a unified management architecture.
7. For public-sector and regulated organizations, policy issuances and audit criteria should explicitly encourage integrated approaches in order to reduce duplicated compliance work and improve institutional learning.
8. Future research should empirically test the proposed framework using survey-based, case-based, and longitudinal designs and examine its applicability in the Philippine industrial and government context.

VII. FUTURE RESEARCH DIRECTIONS

To build on the developmental contribution of this paper and to establish the framework's empirical credibility, future research should pursue the following complementary directions:

1. Pilot implementation studies. Researchers should conduct pilot implementations of the five-phase framework within single units or representative process sets to evaluate practical fit, surface control conflicts between quality and safety requirements, and refine control points before organization-wide adoption.
2. Organizational validation studies. The framework should be validated by ISO practitioners, quality and safety managers, and engineering professionals using content-validity indices, Delphi consensus methods, and structured interviews to confirm the relevance, completeness, and feasibility of its phases, mechanisms, and indicators.
3. Quantitative and statistical validation. Subsequent studies should operationalize the framework's constructs using validated multi-item scales and objective indicators, establishing reliability through Cronbach's alpha, verifying dimensionality through factor analysis, and testing hypothesized relationships through correlation, multiple regression, and structural equation modeling.
4. Multi-industry testing. The model should be tested across diverse sectors—including manufacturing, construction, logistics, utilities, healthcare, education, and public-sector services—to assess its transferability and to identify sector-specific adaptations of its integration mechanisms.
5. Longitudinal assessment. Longitudinal designs should track integration outcomes over time, comparing pre- and post-implementation performance on duplication, audit efficiency, incident and defect rates, and compliance quality, and capturing how integration maturity evolves across the certification life-cycle.
6. Cross-country applications. Comparative studies in different national and regulatory contexts should examine how institutional, cultural, and legal differences shape integration outcomes, thereby clarifying the boundary conditions of the framework beyond the Philippine setting.
7. Digital transformation and Industry 4.0 integration. Future work should explore how digital technologies—integrated management information systems, data analytics, the Industrial Internet of Things, digital twins, and artificial intelligence—can enhance the framework's monitoring, risk-detection, and continuous-improvement capabilities, positioning QMS–SMS integration within the broader trajectory of Industry 4.0.

REFERENCES

- [1] Aichouni, M., Touahmia, M., Alshammari, S., Said, M. A., Aichouni, A. B. E., Almudayries, M., & Aljohani, H. (2023). An empirical study of the contribution of total quality management to occupational safety and health performance in Saudi organizations. *International Journal of Environmental Research and Public Health*, 20(2), 1495. <https://doi.org/10.3390/ijerph20021495>
- [2] Alghaseb, M., & Alshmlani, T. (2022). OSH performance within TQM application in construction companies: A qualitative study in Saudi Arabia. *International Journal of Environmental Research and Public Health*, 19(19), 12299. <https://doi.org/10.3390/ijerph191912299>
- [3] Al-Maaitah, R. A., & Aljbour, S. H. (2022). Impacts of quality management systems on occupational safety and health in industrial laboratories. *International Journal of Human Factors and Ergonomics*, 9(3), 282–310. <https://doi.org/10.1504/IJHFE.2022.126128>
- [4] Ayyadi, I., & Oulhadj, B. (2024). ISO 9001 certification and organizational performance among manufacturing companies: A systematic literature review and research agenda. *Business Strategy & Development*, 7(4), e70044. <https://doi.org/10.1002/bsd2.70044>
- [5] Barbosa, A. de S., da Silva, L. B., Morioka, S. N., da Silva, J. M. N., & de Souza, V. F. (2023). Integrated management systems and organizational performance: A multidimensional perspective. *Total Quality Management & Business Excellence*, 34, 1469–1507. <https://doi.org/10.1080/14783363.2023.2181153>
- [6] Chatzoglou, P. D. (2025). Health and safety management system (HSMS) and its impact on employee satisfaction and performance—A new HSMS model. *Safety*, 11(2), 52. <https://doi.org/10.3390/safety11020052>
- [7] Chountalas, P. T., & Lagodimos, A. G. (2024). Integrated management systems: A content and bibliometric analysis. *The TQM Journal*. Advance online publication. <https://doi.org/10.1108/TQM-04-2024-0164>
- [8] Conda, L. E. A., Nuñez, C. A. V., Uy, D. S. E. T., Artaiz-Cariaga, C. S., Cabigon, J. J. J., & Apostol, G. L. C. (2025). A recent situational analysis of the occupational safety and health landscape in the Philippines. *Acta Medica Philippina*, 59(10), 21–29. <https://doi.org/10.47895/amp.vi0.8944>



International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 07, July 2026)

- [9] Francisco, F. E., Costa, A. C. F., Sampaio, P. A. C. A., Domingues, P., & de Oliveira, O. J. (2024). Implementation and improvement of integrated management systems: Recommendations for their adaptation to the ISO high-level structure. *Cleaner Environmental Systems*, 15, 100227. <https://doi.org/10.1016/j.cesys.2024.100227>
- [10] Hernandez-Vivanco, A., & Bernardo, M. (2023). Management systems and productive efficiency along the certification life-cycle. *International Journal of Production Economics*, 266, 109028. <https://doi.org/10.1016/j.ijpe.2023.109028>
- [11] International Labour Organization. (2023a, November 26). Nearly 3 million people die of work-related accidents and diseases. <https://www.ilo.org/resource/news/nearly-3-million-people-die-work-related-accidents-and-diseases>
- [12] International Labour Organization. (2024). National occupational safety and health strategy initial profile: Philippines 2023. <https://www.ilo.org/sites/default/files/2024-10/National-OSH-strategy-initial-profile-Philippines-2023.pdf>
- [13] International Organization for Standardization. (2026). The ISO survey. <https://www.iso.org/the-iso-survey.html>
- [14] Ispas, L., Mironeasa, C., & Silvestri, A. (2023). Risk-based approach in the implementation of integrated management systems: A systematic literature review. *Sustainability*, 15(13), 10251. <https://doi.org/10.3390/su151310251>
- [15] Ispas, L., Mironeasa, C., & Silvestri, A. (2025). A study on the emergence and resilience of integrated management systems in organizations with an industrial profile in Romania. *Sustainability*, 17(6), 2401. <https://doi.org/10.3390/su17062401>
- [16] Marhavidas, P. K., Pliaki, F., & Koulouriotis, D. (2022). International management system standards related to occupational safety and health: An updated literature survey. *Sustainability*, 14(20), 13282. <https://doi.org/10.3390/su142013282>
- [17] Podrecca, M., Molinaro, M., Sartor, M., & Orzes, G. (2024). The impact of ISO 45001 on firms' performance: An empirical analysis. *Corporate Social Responsibility and Environmental Management*, 31(5), 4581–4595. <https://doi.org/10.1002/csr.2782>
- [18] Wang, J., & Liu, F. (2023). Examining the link between integrated management systems and firm performance: Do the integration strategies matter? *International Journal of Operations & Production Management*, 43(2), 332–372. <https://doi.org/10.1108/IJOPM-04-2022-0277>
- [19] Forman, G. 2003. An extensive empirical study of feature selection metrics for text classification. *J. Mach. Learn. Res.* 3 (Mar. 2003), 1289-1305.
- [20] Brown, L. D., Hua, H., and Gao, C. 2003. A widget framework for augmented interaction in SCAPE.
- [21] Y.T. Yu, M.F. Lau, "A comparison of MC/DC, MUMCUT and several other coverage criteria for logical decisions", *Journal of Systems and Software*, 2005, in press.
- [22] Spector, A. Z. 1989. Achieving application requirements. In *Distributed Systems*, S. Mullende