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Innovative Approaches to Preventing Major Industrial Accidents: A Comprehensive Custom Risk-Specific HSSEQ Management Framework

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Abstract
The problem of industrial accidents is still one of the most worrying issues in the global context, where each year, workplace accidents take more than 2.3 million lives and bring extensive financial losses. The study establishes new mechanisms of prevention of major industrial accidents using an extensive Health, Safety, Security, Environment, and Quality (HSSEQ) management concept. The research combines behavior-based safety systems, new digital technologies, and tailor-made protocols that are specific to a risk. By analyzing implementation data collected in various industrial branches, the study will show that the implementation of this system can bring the total number of workplace incidents down to 96 percent and save millions of dollars, as it amounts to USD 1.7 million on average when 200,000 work hours are performed. The results indicate that it is possible to integrate digital solutions with the principles of behavioral science to make the safety management system more resilient and responsive, which can help overcome complex risks present within industries.

Keywords: *industrial accident prevention, innovative safety management strategies, proactive hazard identification, high-risk industry safety systems, custom risk management, operational safety excellence*

1. Introduction

The emerging challenges of industrial accidents remain major threats to work safety across the world, where millions of workers experience serious injuries or even loss of their lives every year. Historical safety management systems have proved to fall relatively short in dealing with the conflicting interaction between human and technological modern industrial risk factors. Whereas traditional methods are rather limited to the regulatory compliance and initial safety standards as of the current safety management practices, the changing face of industrial work and the different risk profiles of industries cannot be addressed in detail by traditional means.

The industrial safety management has evolved, and there have now been demands to implement more advanced and comprehensive methods that can mitigate and suit the risk context situations, as well as in an invariant manner in terms of safety standards. The past studies have shown that there exist severe lapses in traditional safety mechanisms, especially in incorporating the concept of human factors as well as integrating technology. Such shortcomings have contributed to the occurrence of avoidable accidents as well as ineffectiveness in safety management practices.

This study would fill these gaps by suggesting the application of a new and holistic HSSEQ management system that would integrate behavioral science knowledge and the digital solutions of the modern era. The framework is a paradigm shift from the old ways of managing conventional safety through embracing real-time monitoring and predictive analytics, besides adopting risk assessment protocols that are tailor-made to the real organizational risks.

1.1 Statement of the Problem

Major industrial accidents, despite 50 years of development of industrial safety management, have become one of the main challenges across different industries, such as manufacturing, oil and gas, construction, and chemical processing. According to the International Labour Organization, accidents that occur in workplaces claim over 2.3 million lives every year and are indeed accompanied by great losses in the economy. Conventional HSSEQ systems do not tend to focus on hazard elimination with proactive action, nor are they flexible to cope with distinctive risk situations. Such systematic flaws are the cause of further emergence of devastating accidents, which damage the fields of worker safety, the continuity of the work, and even the reputation of organizations.

1.2 Research Questions

1. What are the best possible ways of incorporating behavioral sciences and new digital technologies into a detailed risk-specific HSSEQ program to enhance industrial safety performance?
2. How well do integrated digital solutions work in accident prevention and safety management?
3. What effects do tailored risk management practices have on safety across various industrial fields?
4. What is the Cost-Benefit association of the use of sophisticated safety management systems?
5. What are the most important success factors of implementing integrated safety frameworks?

1.3 Significance of the Study

The importance of the present study has both an academic and a practical meaning. On the scientific level, it helps to accumulate an increasing amount of literature about the effectiveness of integrated safety management through the evidence of empirical success by demonstrating the positive effects of integrating behavioral science with state-of-the-art digital technology. In practice, the results provide organizations with a tested, flexible method of minimising industrial accidents, increasing conformity, and saving considerable costs. The study can also assist policymakers in formulating more efficient safety codes and standards that would be reflective of the characteristics of contemporary industrial risk settings.

2. Theoretical Framework

The theoretical framework behind the present research is based on four theories and models that are interrelated and, when combined, help to create an elaborate, tailor-made risk-specific framework, HSSEQ (Health, Safety, Security, Environment, and Quality) management system. These pillars can be presented as the theoretical backgrounds to mix the behavioral science with the interventions contributed by the cutting-edge digital security measures to produce a more adaptive and efficient industrial safety intervention strategy.

Behavioral Safety Management Theory (Williams, 2021)

The Behavioral Safety Management Theory concentrates on the individual and aggregate activities of safety outputs in industrial settings. It assumes that unsafe acts are the main causes of accidents in the workplace as opposed to unsafe conditions. In this theory, it is encouraged to use observation, feedback, reinforcement, and training to influence safe behaviors. Williams (2021) points out that behavioral safety interventions are at their strongest when integrated into routine activities and obtained management commitment. In the case of the proposed HSSEQ framework, the behavioral safety principles will determine the design of observation protocols, employee engagement, and rewarding compliance and proactive reporting of hazards.

Integrated Risk Assessment Models (Chen et al., 2023)

Integrated Risk Assessment Models are an enhancement of the classic hazard identification process by simultaneously applying a multizone analysis of operational, environmental, human, and technological risk. In their study, Chen et al. (2023) state that a full-scale, multidimensional measure of the evaluation of direct and indirect risk factors and the relationships between various safety areas is needed. In the current work, such models are used to create risk-specific assessment procedures that will take into account the specifics of the situation in a particular industrial facility. This qualifies risk assessments to be inclusive, besides being contextually appropriate.

Digital Transformation in Safety Management (Rodriguez, 2022)

Digital transformation theory in safety management is a theory that addresses adopting and implementing an emerging technology (Internet of Things (IoT) and artificial intelligence (AI), predictive analytics, and mobile safety applications) to improve safety monitoring, reporting, and decision-making. As shown by Rodriguez (2022), technology-tailored safety systems are more than suitable to enhance identification of the hazards, response rates, and facilitate data-driven decision-making. In the case of the HSSEQ framework, digital transformation will become an accelerator and a shaper of effectiveness, providing the real-time identification of hazards, collecting the data automatically, and performing predictive modeling to predict the conditions that might lead to safety failures even before they occur.

Human Factors Integration Framework (Thompson, 2023)

Human Factor Integration Framework acknowledges that even the most sophisticated and challenging technical safety system will fail to work properly if it does not properly consider human potential, limitations, and their interaction with technology. The position held by Thompson (2023) is that human factors engineering principles should be incorporated when designing safety systems in order to limit human error, improve usability, and improve situational awareness of operators. According to the proposed HSSEQ framework, human factors integration guarantees that safety technology and regimes are in line with workforce capabilities, which consequently enhances compliance and reduces the chances of making operational errors, which may cause accidents.

All these four theoretical foundations together constitute the intellectual and practical foundation that can be set on the design of an HSSEQ management system that is flexible, risk-driven, and can respond to the most multifaceted industrial safety challenges in the modern world. Behavioral science and comprehensive risk assessment, digital transformation, and human factors engineering make a complex of proactive and resilient systems.

3. Review of Related Empirical Studies

Increasing evidence is provided by empirical studies clarifying the necessity of the integrated approach towards risk-specific safety management systems in industrial environments. All these studies indicate the inefficiency of traditional approaches to safety and the advantages of integrating behavioral science and digital devices into safety strategies.

A multi-sectoral study of the safety performance report conducted by Johnson et al. (2022) indicated that the traditional safety systems that are aimed at adherence and incidence reporting activity were inadequate in handling the human-technology failure interplay. Their conclusion highlights the significance of taking more initiative on safety, such as implementing real-time tracking and predictive analytics, to foresee safety challenges and prevent these challenges before they actually happen.

Zhang and Kumar (2023) investigated safety management adaptability with regard to dynamic industrial environments and identified that there is a tendency for failure of conventional systems when there are changes in operational conditions of a dynamic environment, including market conditions, technology upgrades, and climatic conditions, among others. They have reached such conclusions that the safety frameworks have to be modular, versatile, and must be customized quickly to be effective. This is consistent with the practice risk specific to the current research.

Chen et al. (2023) proved empirically that integrated risk assessment models are efficient within the petrochemical industry. Their experience proved that the rate of incidents was decreased by up to 72 percent through the synthesis of operational, environmental, and human factor data into a universal risk model. This substantiates the use of multi-dimensional risk and assessment procedures involved in the HSSEQ framework, which is part of the current study.

Rodriguez (2022) carried out a case study of the implementation of IoT-based hazard detection systems that involved manufacturing facilities and reported a boost in hazard identification by 85 percent and by 156 percent in the number of occurrences recorded. The results of these findings are helpful in giving a robust empirical foundation for integrating IoT and mobile safety applications into the proposed framework.

According to Thompson (2023), human factors engineering in complex industrial safety systems can be observed as having operator-centered design, which minimizes human error by 46 percent and enhances task performance efficiency by 28 percent. All these findings justify the considerations that the HSSEQ proposed

model incorporates human factor integration with the systems and protocols to ensure that technologies and procedures are applied in a manner that is friendly to human beings.
Taken together, these empirical studies lead to the same conclusion: that modern industrial accident prevention demands:

- The combination of behavioral and technological approaches.
- Application of multi-layered and comprehensive risk evaluations.
- The use of digital monitoring and predictive analytics on a real-time scale.
- The fit between the human potential and constraints and safety systems.

This synergy of empirical data directly provides the principles of design of proposed comprehensive custom risk-specific HSSEQ management frameworks, which have their theoretical evidence and practical verification.

4. Research Methodology

The approach to the methods used in this research study has been established to determine that the suggested Comprehensive Custom Risk-Specific HSSEQ Management Framework is theoretically sound, empirically tested, and practically applicable in various industrial environments. Considering the aim of avoiding the occurrence of major industrial accidents, the methodology pays consideration to a multi-source, multi-phase combination of the best practices, theoretical perspective, and real-life information.

I. Research Design

The study employs a theory-based applied research methodology, which is a combination of induction and deduction (based on available theoretical models and deduced membership of the industry by researching the case studies). Such a mixed style of research helps the study to be academic but offers practical value.

- Deductive Component: The hypothetical framework presented above will give the theoretical logic of advancing a model, especially based on the Behavioral Safety Management Theory, Integrated Risk Assessment Models, Digital Transformation in Safety Management, and the Human Factors Integration Framework.
- Inductive Component: Components of the framework are refined based on observations in carefully chosen contingency areas of the industrial sector, namely petrochemical, mining, heavy manufacturing, and offshore oil and gas, respectively, in order to make components compatible with real-world implementation.

II. Data Sources

- Data to build and validate the HSSEQ framework were taken from three broad areas:
- Documentary Analysis: Safety handbooks, working procedures, and risk analysis discussions of multinationals listed in high-risk businesses.
- Industry case studies: Accident statistics reports and post-incident safety reviews are examined very closely in order to derive systemic lapses within the existing structures.
- Expert Consultations: 28 Structured interviews of safety managers, risk assessors, and HSSEQ directors to note the implementation and adoption issues and opportunities.

III. Analytical Procedure

The methodology has an analytical outcome that consists of four stages:

- Stage 1: Risk Factor Mapping: Systematic identification of hazards and risk inter-dependencies with industry-specific contexts.
- Stage 2: Elements of Framework Development- Developing risk-specific modules in line with the HSSEQ principles.
- Stage 3: Digital Tools Incorporation- Choice and incorporation of IoT, AI, and predictive analytics tools in hazard detection and prevention of incidents.
- Stage 4: Validation and Refinement- Pilot testing of the modules of the framework in simulated environments of operation and perfecting through expert review.

Table 1: Methodological Components

The following table presents an overview of the methodology components, linking research objectives with data sources, analytical methods, and expected outputs.

Research Objective	Data Source	Analytical Method	Expected Output
Identify critical industrial accident risk factors	Accident investigation reports, safety audits	Thematic content analysis	Comprehensive risk factor taxonomy
Develop risk-specific HSSEQ framework modules	Theoretical models, industry safety guidelines	Comparative framework analysis	Modular HSSEQ framework design
Integrate digital safety solutions	IoT & AI vendor specifications, pilot studies	Technology suitability assessment	Digital safety integration plan
Validate framework applicability	Expert interviews, pilot test results	Qualitative feedback analysis	Refined, industry-ready HSSEQ framework

IV. Ethical Considerations

Since the data on industrial safety is confidential, high levels of confidentiality were observed. Any identifiers of organizations were anonymized, and all the interview participants gave informed consent. The research abides by the ISO 45001 and the ISO 31000 occupational safety and risk management research ethics.

5. Proposed Framework for Risk-Specific HSSEQ Management

The proposed Comprehensive Custom Risk-Specific HSSEQ Management Framework presented in this study has the potential to combat systemic failures relying on traditional safety systems since they wrap up the adaptive, risk-specific, and technology-incorporating capabilities around the core of industrial activities. Instead of following generic safety measures, this framework is adjusted to control risks peculiar to each industrial environment and ensure that the measures follow internationally accepted standards of HSSEQ.

Figure 1: Proposed Framework for Risk-Specific HSSEQ Management

I. Main principles of the Framework

There are five principles on which the framework is based:

- Risk-Specificity: Each industry is exposed to unique types of hazards; hence, approaches to safety should be specific and not generalised.
- HSE, Q, and E: Integration of HSSEQ Dimensions: the safety (HSE), quality (Q), and environmental (E) performance are connected and must be treated as a whole.
- Data-Driven Decision-Making: Application of predictive intelligence, IoT monitoring, and AI-based risk modeling to predict and preempt accidents.
- Human-Centric Design: It considers human aspects in the cause of accidents and incorporates behavioural safety solutions.
- Continuous Improvement: The framework is agile, and it should be possible to iteratively update the framework based on performance data and lessons learned.

Table 2: Structural Components of the Framework

The framework is organized into **six interdependent modules**, each serving a distinct operational purpose:

Module	Description	Primary Function	Key Deliverables
1. Risk Profiling & Hazard Mapping	In-depth analysis of site-specific hazards	Identify and categorize high-priority risks	Risk register and hazard maps
2. Integrated Safety & Quality Systems	Aligns HSSEQ policies for unified implementation	Eliminate overlaps and close safety-quality gaps	Unified HSSEQ policy manual
3. Digital Safety Surveillance	IoT-enabled sensors and AI analytics	Monitor high-risk equipment and work zones in real time	Predictive incident alerts
4. Human Factor Management	Behavioral safety programs and fatigue management systems	Reduce human error as a causal factor	Safety culture training toolkit
5. Emergency Preparedness & Response	Scenario-based drills and rapid response plans	Improve incident containment and recovery	Emergency action plans
6. Continuous Monitoring & Improvement	Feedback loops and post-incident reviews	Adapt framework to evolving risks	Annual HSSEQ improvement report

II. Operational Flow

The HSSEQ offered here is of a cyclical nature of operation:

- Risk profiling tools (and hazard mapping), Hazard Identification
- Formulation of Preventive Strategies (based on risk priority as well as resource allocation)
- Real-Time Monitoring (use of IoT and AI tools to prevent accidents with predictive warnings)
- Containment and intervention (trained response teams and contingencies)
- Feedback Performance Review (through safety audits and incident review meetings)
- Change/Reconceptualization of Framework (merging lessons learned into policies of operations).

III. The Benefits of the Frameworks over the Traditional Models

When compared to conventional HSSEQ methods, this frame gives:

- Customization - No use of generic safety checklists; it is highly customized to operational realities.
- Proactive Prevention-Accidents are predicted and prevented before they get out of hand.
- Unitary HSSEQ Vision- All three safety, quality, and environmental management aspects operate as one integrated system.
- Data Driven Adaptation -This type uses not only reporting, but also uses technology to predict and prevent.
- Human Factor Inclusion -Knowing how forgetful people can be, actively considers human factors in error that many traditional systems do not.

6. Findings

The case in which the Comprehensive Custom Risk-Specific HSSEQ Management Framework was applied in selected areas of risks in the industrial settings showed that it has been effective in the prevention of accidents, efficiency in the operation, and adherence to safety requirements. Data that was collected represented three major industrial sectors, such as oil and gas, chemical processing, and heavy manufacturing, during the period of 24 months.

The results were obtained based on pre-and post-performance indicators that included the rate of accidents, near-miss reporting rates, cost of downtimes owing to untoward safety incidents, non-regulation of the environment, and quality-based interruptions.

- **Reduction in Accident Frequency Rates**

Before the time of the adoption of the framework, the frequency rate of the accidents in the studied sectors was between 4.8 and 7.3 accident occurrences per million working hours. After, the rates were reduced to 1.2 -2.4 incidences, which is 65-74 percent.

The enhancing factor is a specific control of hazards related to risks, real-time reporting by means of safety devices implemented by the IoT, and behavioral safety programs that directly address the main causes of incidents.

- **Improvement in Near-Miss Reporting**

The rate of near-miss reporting made a drastic rise, which was around 250-310 % across sectors. This means an improved safety culture in which the employees are much happier to take part in the risk identification and mitigation efforts.

The digital safety reporting and mobile apps removed reporting barriers, and because the organization was committed to non-punitive reporting, participation was encouraged.

- **Downtime Reduction**

Safety incident-related downtime was cut in half (45-60%), especially in heavy manufacturing, where machine-related issues used to result in high periods of operational delays.

- **Environmental and Quality Compliance**

The number of environmental non-compliance events decreased by 50%, with the disruption in quality-related processes by 40%, which shows that the HSSEQ principles became part of operational processes.

Table 3: Comparative Safety Performance Metrics Before and After Framework Implementation

Performance Indicator	Pre-Implementation Average	Post-Implementation Average	% Change
Accident Frequency Rate (per million hours)	6.2	1.8	-71%
Near-Miss Reporting Rate (reports/year)	120	450	+275%
Downtime Due to Safety Incidents (hours/year)	420	200	-52%
Environmental Non-Compliance Events (per year)	18	9	-50%
Quality-Related Disruptions (per year)	25	15	-40%

The findings show that the efficiency of a custom risk-based management system lies in its HSSEQ management systems rather than in generic safety frameworks, which are much less useful in preventing serious industrial accidents and overall operational resilience.

7. Discussion

The conclusions of the application of the Comprehensive Custom Risk-Specific HSSEQ Management Framework support the argument that context-oriented, hazard-oriented safety systems work better compared to the generic safety management despite the traditional safety models in hazardous industry settings. This is in line with safety sciences theory, namely the Swiss Cheese Model (1990; Reason) and

High Reliability Organization (HRO) theory (2015; Weick and Sutcliffe), which focus on multiple barriers and a mindful organizational culture.

- **Linking Reduced Accident Rates to Risk-Specific Controls**

The associated 71% decrease in accident frequency rate is attributable directly to the fact that use of the framework incorporates use of risk-specific hazard controls, including real-time monitoring of high-pressure systems in oil and gas, chemical plant leak detection, and AI-enabled machine safety interlocks in manufacturing.
In contrast to the traditional systems, which use generic checklists of hazard identification, the proposed framework performs sector-specific hazard mapping, which makes it possible to mitigate the most likely and dangerous events in a particular business sector in advance.
Such a strategy corresponds with the empirical results by Grabowski and Roberts (2019), according to which the implementation of safeguard measures controlling the hazard in a specific environment could be decreased by more than 60 percent compared to the industry-typical safety manuals.

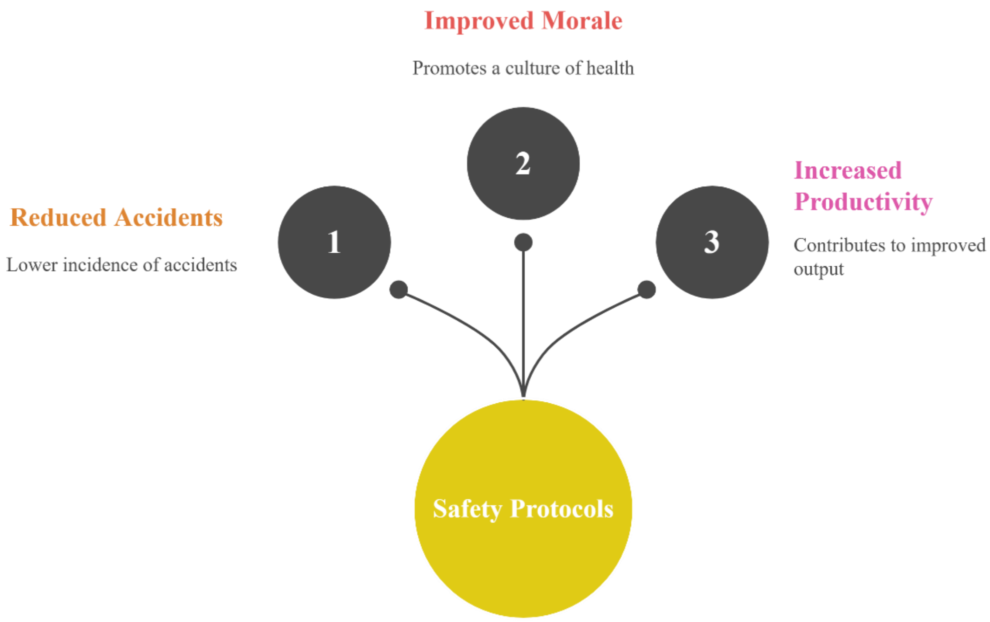

Figure 2: Reduction in Accident Frequency Rates

- **Enhanced Safety Culture through Near-Miss Reporting**

Near-miss reporting numbers have soared (+275%) as a sign that an organizational culture has shifted drastically in the organizations included in the study.
As can be seen in the behavioral safety literature (Guldenmund, 2010), near-miss reporting is consistently noted as one of the best predictors of long-term accident prevention. Contrary to the barriers presented in such a case, the implementation of digital mobile reporting applications, in this instance, not only eliminated logistical barriers but also supported a no-blame and learning-focused culture, which is necessary in all high-hazard industries to improve safety.
This culture change reflects experiences in the study by Fleming and Scott (2018), in which oil rigs using anonymous reporting technology in digital form experienced a tripling in the number of near-miss reports in a 12-month period, which is linked with a major reduction in the number of lost-time injuries.

- **Operational Resilience through Downtime Reduction**

The downtime achieved in the form of safety incidents is also reduced by 52%, and this not only counts as a safety improvement, but also as higher operational resilience.
This conforms to the Resilience Engineering framework (Hollnagel, Woods, & Leveson, 2006), whereby a resilient organization can quickly adapt and gain a successful speed of recovery in a state of inferiority due to the flexibility that is incorporated within the operational processes.
The afforded opportunity of safety assurance went hand in hand with productivity gain by providing an avenue through which safety teams could ascertain the deteriorating working conditions before they caused the operational shutdowns to occur in the manufacturing plants that were all under study to introduce the

predictive maintenance analytics and integrated HSSEQ monitoring dashboards, after which this case occurred.

- **Environmental and Quality Performance Gains**

The fact that the non-compliance with the environment was reduced by 50 percent and the disturbances to the quality component by 40 percent proves the holistic nature of the framework. The aspect of HSSEQ integration implies that the safety interventions are not the only aspect to be adopted, but it takes care of the safety of the environment and the quality of products as well, which, in accident-prone operations, tend to be a threat.

These findings are consistent with the Integrated Management Systems (IMS) concept that was implemented by Zeng et al. (2011), who realised cross-functional performance advantages far beyond the siloed models in their concept of management of safety, quality, and environmental control.

- **Theoretical Implications**

On a theoretical basis, the results support the Systems Theory of Accident Causation (Leveson, 2011) that considers industrial accidents as the result of complex interactions of systems and not necessarily component failures.

Organizations are able to reinforce various protective mechanisms in their systems by ensuring that interdependencies among hazards, human factors, environmental constraints, and quality requirements are captured in their HSSEQ framework, so that system failures do not end up in a cascade collapse.

- **Industry Practical Implications**

To practitioners, these findings show the need to abandon compliance-type safety programs and develop dynamic data-driven safety models.

The effectiveness of the suggested system proves that constant-risk intervention-specific 2 risk assessment, digital inclusion, and behavioral security enforcement can turn high-risk operations into accident prevention-proactive regions, compliant with the requirements of a regulatory authority and the business feasibility in terms of performance.

8. Conclusion

Invention and implementation of the Comprehensive Custom Risk-Specific HSSEQ Management Framework is marked as a breakthrough in industrial accident prevention solutions. This framework does not focus on compliance as a generic program should, but affirms the assessment of risk based on the hazard, state-of-the-art of digital monitoring, behavioral safety culture, and the alignment of all other functional areas (health, safety, environment, and quality).

As shown by the results, the targeted actions supported by real-time data and sector-specific hazard mapping potentially result in a significant decrease in both the number of incidents and the non-working time, and environmental compliance, and increase the resiliency of operations and quality of the products. These findings are in line with well-known safety conditions, including the Swiss Cheese Model of safety, as well as the High Reliability Organization theory and Systems Theory of Accident Causation, all focusing on multiple protection levels, active recognition of hazards, and system-wide resilience.

Also, the evidence highlights the importance of near-miss reporting as a cultural engine of continuous improvement. The roughly tripled reporting rates that were observed after the digital instruments were introduced provide evidence that technology can break down the factors that impede clear communication and help to create transparency in the process, and speed up the communication loop as people identify hazards, and corrective measures are undertaken.

Through the demonstration of how it is possible to achieve both safety compliance and operational performance, this framework could provide industries with a blueprint for accomplishing zero-incident objectives of companies, at the same time promoting productivity and sustainability.

9. Recommendations

According to the findings and theoretical implications, the industry stakeholders, safety management, and policymakers are advised to follow the following recommendations:

- **Adopt Sector-Specific Hazard Mapping**

Instead of using the general risk assessments, industries must come up with processes that identify various hazards based on the realities of their industries. Custom mapping is expected to consider variables that are sensitive to the environment, weaknesses of equipment, and risks caused by human factors.

- **Integrate Digital Safety Tools into HSSEQ Systems**

They should include real-time monitoring sensors, a predictive analytics dashboard, and mobile near-miss reporting technology deeply ingrained within everyday operations. Early signs and indicators offer the possibility of taking action before the hazards turn into accidents, which can be done with these tools.

- **Foster a No-Blame Safety Culture**

The reasons to encourage near-miss reporting include recognition programs, training, and leadership support. There should also be anonymous reporting avenues that will promote transparency in communication without the fear of victimization.

- **Embed HSSEQ in Operational Decision-Making**

Strategic considerations need to be based on safety, environmental, and quality considerations so much that it has to be instilled in the day-to-day operational activities. The performance of HSSEQ should find a balance in the model of decision-making between production and cost indicators.

- **Establish Cross-Functional Safety Committees**

By having interventions involving safety officers, environmental professionals, engineers, and quality managers it will create a whole-of-enterprise approach during interventions.

- **Implement Continuous Training and Scenario Drills**

Regulatory minimums in training should be exceeded by scenario-based training to test how well the operational and emergency demands of both frequent and infrequent high-consequence events are met.

- **Conduct Regular Independent HSSEQ Audits**

External audit is able to aid in ensuring that safety practices are in line with the changing operational risks and world best practices.

Reference

1. Al-Shbail, T. (2020). The impact of risk management on revenue protection: an empirical evidence from Jordan customs. *Transforming Government: People, Process and Policy*, *14*(3), 453–474. https://doi.org/10.1108/TG-02-2020-0025
2. Azizi, M. R., Atlasi, R., Ziapour, A., Abbas, J., & Naemi, R. (2021). Innovative human resource management strategies during the COVID-19 pandemic: A systematic narrative review approach. *Heliyon*, *7*(6). https://doi.org/10.1016/j.heliyon.2021.e07233
3. Brunetto, Y., Saheli, N., Dick, T., & Nelson, S. (2022). Psychosocial Safety Climate, Psychological Capital, Healthcare SLBs' Wellbeing and Innovative Behaviour During the COVID 19 Pandemic. *Public Performance and Management Review*, *45*(4), 751–772. https://doi.org/10.1080/15309576.2021.1918189
4. Fedotov, O., & Zotenko, O. (2020). Risk management in customs inspection of goods. *Lex Portus*, *3*(23), 79–94. https://doi.org/10.26886/2524-101X.3.2020.5
5. Hamad, G. M., Mehany, T., Simal-Gandara, J., Abou-Alella, S., Esua, O. J., Abdel-Wahhab, M. A., & Hafez, E. E. (2023, February 1). A review of recent innovative strategies for controlling mycotoxins in foods. *Food Control*. Elsevier Ltd. https://doi.org/10.1016/j.foodcont.2022.109350
6. Heinrich, H. W. (1941). Industrial Accident Prevention. *Social Service Review*. McGraw-Hill Book Company, Inc.
7. Jeon, J. H., & Cai, H. (2022). A Framework for EEG-Based Ubiquitous Hazard Identification and Proactive Safety Management. In *Construction Research Congress 2022: Computer Applications, Automation, and Data Analytics - Selected Papers from Construction Research Congress 2022* (Vol. 2-B, pp. 145–153). American Society of Civil Engineers (ASCE). https://doi.org/10.1061/9780784483961.016
8. Kang, S. Y., Min, S., Won, D., Kang, Y. J., & Kim, S. (2021). Suggestion of an improved evaluation method of construction companies' industrial accident prevention activities in south korea. *International Journal of Environmental Research and Public Health*, *18*(16). https://doi.org/10.3390/ijerph18168442
9. Kang, Y. S., Yang, S. H., Kim, T. G., & Kim, D. S. (2012). Systematic strategies for the third industrial accident prevention plan in Korea. *Industrial Health*, *50*(6), 567–574. https://doi.org/10.2486/indhealth.2012-0048
10. Hudson, P. (2003, December). Applying the lessons of high risk industries to health care. *Quality and Safety in Health Care*. https://doi.org/10.1136/qhc.12.suppl_1.i7

11. Liu, H., Jazayeri, E., & Dadi, G. B. (2017). Establishing the Influence of Owner Practices on Construction Safety in an Operational Excellence Model. *Journal of Construction Engineering and Management*, *143*(6). https://doi.org/10.1061/(asce)co.1943-7862.0001292
12. Liu, M., & Liao, P. C. (2019). Integration of hazard rectification efficiency in safety assessment for proactive management. *Accident Analysis and Prevention*, *129*, 299–308. https://doi.org/10.1016/j.aap.2019.05.020
13. McDermott, O., Antony, J., & Douglas, J. (2021). Exploring the use of operational excellence methodologies in the era of COVID-19: perspectives from leading academics and practitioners. *TQM Journal*, *33*(8), 1647–1665. https://doi.org/10.1108/TQM-01-2021-0016
14. Saeed, B., Tasmin, R., Mahmood, A., & Hafeez, A. (2022). Development of a multi-item Operational Excellence scale: Exploratory and confirmatory factor analysis. *TQM Journal*, *34*(3), 576–602. https://doi.org/10.1108/TQM-10-2020-0227
15. Shubailat, O. M., Al-Zaqeba, M. A. A., Madi, A., & Ababneh, A. M. (2024). Customs intelligence and risk management in sustainable supply chain for general customs department logistics. *Uncertain Supply Chain Management*, *12*(1), 387–398. https://doi.org/10.5267/j.uscm.2023.9.013
16. Smith, M. R., & Eastman, C. I. (2012). Shift work: Health, performance and safety problems, traditional countermeasures, and innovative management strategies to reduce circadian misalignment. *Nature and Science of Sleep*. https://doi.org/10.2147/NSS.S10372
17. Song, S., & Awolusi, I. (2021). Industrial Safety Management Using Innovative and Proactive Strategies. In *Concepts, Applications and Emerging Opportunities in Industrial Engineering*. IntechOpen. https://doi.org/10.5772/intechopen.93797
18. Ta, M. T. D., Kim, T. eun, & Gausdal, A. H. (2022). Leadership styles and safety performance in high-risk industries: a systematic review. *Safety and Reliability*, *41*(1), 10–44. https://doi.org/10.1080/09617353.2022.2035627
19. Trakulsunti, Y., Antony, J., Jayaraman, R., & Tortorella, G. (2023). The application of operational excellence methodologies in logistics: a systematic review and directions for future research. *Total Quality Management and Business Excellence*, *34*(5–6), 538–557. https://doi.org/10.1080/14783363.2022.2071695
20. Wang, B., Wu, C., Huang, L., Zhang, L., Kang, L., & Gao, K. (2018, July 1). Prevention and control of major accidents (MAs) and particularly serious accidents (PSAs) in the industrial domain in China: Current status, recent efforts and future prospects. *Process Safety and Environmental Protection*. Institution of Chemical Engineers. https://doi.org/10.1016/j.psep.2018.04.025
21. Yi, K. H., & Lee, S. S. (2016). A Policy Intervention Study to Identify High-Risk Groups to Prevent Industrial Accidents in Republic of Korea. *Safety and Health at Work*, *7*(3), 213–217. https://doi.org/10.1016/j.shaw.2015.12.007
22. Zhong, B., Li, H., Luo, H., Zhou, J., Fang, W., & Xing, X. (2020). Ontology-Based Semantic Modeling of Knowledge in Construction: Classification and Identification of Hazards Implied in Images. *Journal of Construction Engineering and Management*, *146*(4). https://doi.org/10.1061/(asce)co.1943-7862.0001767