Multidisciplinary Journal of Healthcare (MJH)

ISSN Online: 3078-3011 ISSN Print: 3078-3003

Volume No: 02 Issue No: 01 (2025)

Operational Efficiency Meets Safety: Leveraging Industrial Management Principles to Strengthen EHS Performance

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ABSTRACT

Background: The operational efficiency objectives of industrial enterprises often conflict with their environmental, health, and safety performance. However, in recent years, there is evidence that safety and productivity are not contradictory if they are integrated into the organization's management system. This paper addresses the issue of applying industrial management principles to achieve operational efficiency and environmental, health, and safety performance, including lean management, total quality management, and proactive safety culture. The paper provides an overview of how the main principles of industrial management can be used to improve both productivity and environmental, health, and safety performance.

Methodology: A study examining the application of industrial management principles to enhance both operational efficiency and environmental, health, and safety performance was conducted using a systematic literature review and thematic synthesis approach. The research involved a comprehensive search of academic databases, case studies, and industry reports. Insights from organizational psychology, risk management, and systems engineering were also integrated to provide a multidisciplinary perspective. The aim was to evaluate how managerial practices, safety systems, and organizational culture interact with workplace safety and environmental, health, and safety performance. A mixed-methods approach was employed to ensure a balanced understanding of both quantitative safety metrics and qualitative cultural factors.

Results: The findings from the review and analysis indicate that leadership commitment, worker participation, and effective safety management systems are critical factors in reducing incidents and enhancing resilience. Organizations that integrate safety into their core business processes tend to have higher competitiveness, lower accident rates, and improved reputational capital. The synthesis highlights the role of psychological safety in enabling proactive reporting, innovation, and a sense of shared responsibility, which are directly linked to better environmental, health, and safety performance. On the other hand, neglecting safety competencies in favor of production targets can increase risks and reduce organizational sustainability. The literature suggests that industrial management principles such as lean, total quality management, and proactive safety culture, when effectively implemented, contribute significantly to both operational and environmental, health, and safety performance. This integrated approach not only mitigates risks but also enhances overall business resilience and competitiveness.

Conclusions: Incorporating industrial management principles with environmental, health, and safety management transforms safety from a compliance obligation to a strategic business advantage. A culture of psychological safety and proactive engagement not only

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ISSN Online: 3078-3011 ISSN Print: 3078-3003

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reduces workplace hazards but also drives operational excellence, innovation, and long-term competitiveness. The research highlights the need for a paradigm shift, where safety is managed with the same rigor as other business-critical functions, such as quality, cost, and productivity. This positions environmental, health, and safety performance as a cornerstone of sustainable industrial success.

Keywords: Operational Efficiency, Environmental, Health, and Safety (EHS), Industrial Management Principles, Lean and Total Quality Management (TQM), Safety Culture and Leadership Commitment, Psychological Safety and Worker Engagement.

INTRODUCTION

The interplay between operational efficiency and environmental, health, and safety (EHS) performance is a critical concern for modern industrial enterprises, necessitating a comprehensive strategy that prioritizes safety within organizational operations (Pagell et al., 2015; Ferrá et al., 2024). The rationale for this integrated approach is multifaceted, reflecting the complex demands of modern industrial operations. On one hand, there is a pressing need to manage risks, comply with regulations, and uphold a commitment to safety (Neusiedl & Radan, 2018). On the other hand, there is an equally compelling requirement to enhance productivity and performance (Claes et al., 2020). These dual imperative challenges the traditional perception of safety and productivity as opposing goals (Neill, 2004). Recognizing that effective management of occupational safety and health is a core business process essential for the sustained growth and economic viability of any enterprise is crucial (Domínguez et al., 2020). Safety should, therefore, be managed with the same level of rigor and strategic focus as other critical business functions (Crutchfield, 1981). This perspective also places direct responsibility on line management for the successful implementation of safety measures (Crutchfield, 1981). It further suggests that the way an organization's management and culture are structured and executed has a significant impact on its ability to achieve both high productivity and high safety outcomes (Pagell et al., 2013). This highlights the importance of understanding the role of management practices and organizational culture in both productivity and safety performance (Saad et al., 2024).

OBJECTIVE

The goal of this study is to provide a thorough review of the existing literature and integrate the most current practices and scholarly articles to examine how industrial management techniques can be successfully used to improve EHS performance. To achieve the aforementioned goal, a more in-depth inquiry into how managerial practices, corporate culture, and maintenance strategies can be harnessed to improve both safety and operational performance was required. The investigation shifted away from the conventional viewpoint in which safety improvement activities were thought to operate in isolation from operational efficiency objectives (Krauss & Casey, 2014). Instead, it supported a systems approach that considered safety as an integral component of the entire organizational structure (Vranješ et al., 2020). This also included a discussion on how a number of industrial management principles can be applied to boost EHS performance by improving both operational effectiveness and risk management (Shevchenko et al., 2018).

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This includes lean manufacturing, total quality management, and proper maintenance. The following sections of this paper will go into more depth on each of these aspects, describing how they can be effectively utilized and integrated into the organization's broader EHS strategy (Smith & Harris, 1992). The study also demonstrated that, just like quality, cost, and time, safety can be strategically used as a method for achieving production capabilities (Sawhney & Knight, 1992). Safety performance and EHS performance are also strongly tied to management's overall commitment to safety (Threadgold, 2012). The emphasis on prevention over reaction and the overall well-being of employees is a proactive, rather than reactive, stance on safety (Vitrano & Micheli, 2024). This study also showed that implementing a good safety management system was an excellent way to help companies meet their legal obligations under occupational health and safety regulations. Safety systems are also used to address issues that come up with process safety management, ergonomics, and industrial hygiene (Roussel & King, 2012). Both protecting people and contributing to the company's long-term financial stability and reputation are essential (Samarasinghe & Heenatigala, 2024). This study also shows that EHS management integration into the industrial management framework can help companies lower the costs of accidents and significantly improve productivity and corporate image (Azmi et al., 2014).

The use of international standards such as ISO 45001, which provides the occupational health and safety management system requirements and is designed to be used by any type of organization, is an example of such integration (Górny, 2018). Top management leadership, risk-based thinking approach, and active participation of the workers are the three main principles of this proactive and preventive international standard for safety (Claro et al., 2025). Furthermore, the standard also aids in the integration of safety management with other management systems, such as quality management and environmental management, for a more streamlined and effective management system (Wilkinson & Dale, 1999).

Conceptual Framework: Integration of Industrial Management Principles with EHS

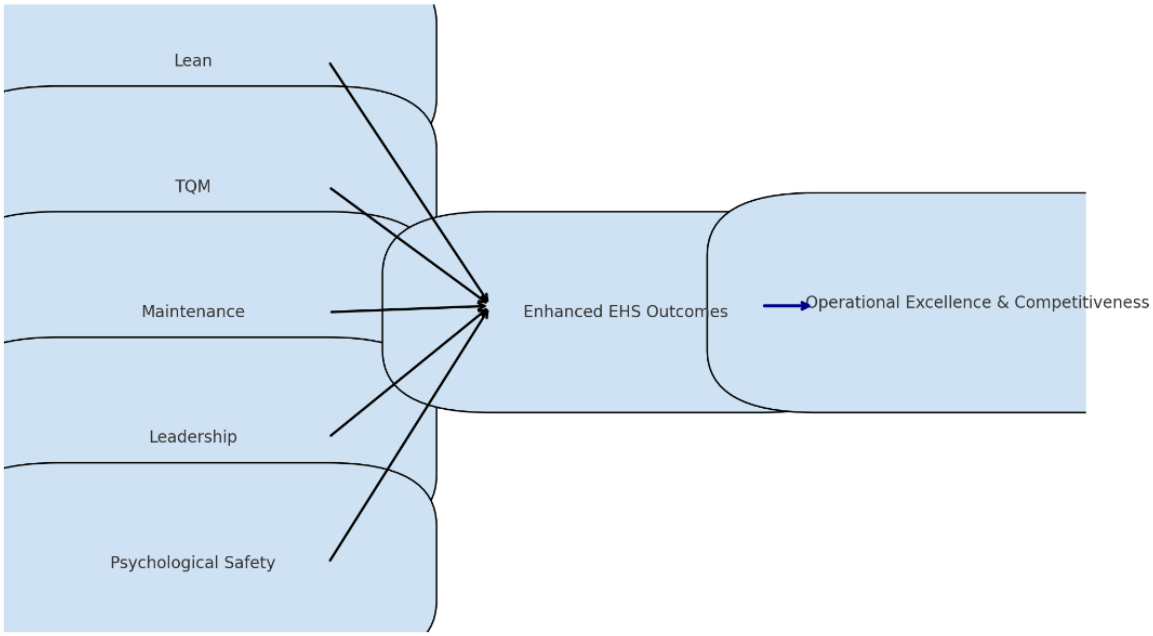

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Diagram 1: Conceptual Framework Diagram

On the other hand, the process of integrating these systems into one could foster a strong, safe, and healthy culture within the organization, which is a prerequisite for any attempt at achieving "operational excellence" that is sustainable (Zutshi & Sohal, 2005; Górny, 2018). Such a comprehensive approach enables organizations to create an enabling and comfortable working environment, thereby enhancing the safety and well-being of employees (Haslam et al., 2015). The approach not only helps improve the quality of working life for employees but also enables organizations to reduce accidents, costs, and increase profits (Haslam et al., 2015). This suggests that organizations need to adopt a holistic approach to developing occupational health and safety management systems that can address the health and safety of all employees in the workplace, and that are followed and continually developed to manage the risks associated with hazards in the workplace systematically (Mtikitiki et al., 2025). Occupational health and safety management systems are processes and procedures developed to be followed by all employees in the workplace, effectively addressing health and safety risks. They are considered by organizations at all times (Mtikitiki et al., 2025). The system should include preventive health, safety, and environmental processes at all times and should be taken into consideration by all functions (Elke, 2000). Occupational health and safety management systems have also been referred to as systemized approaches followed by all employees in the organization at all times, and more specifically, HSE Management Systems, which provide a way for organizations to control and manage risks (Mtikitiki et al., 2025).

LITERATURE REVIEW

The most important and effective of the above approach is the need for organizations to develop and show that they care about their employees well-being and a healthy safety culture (Jemai et al., 2021). However, in the last two decades, despite all the improvements on the ground in the legislations, standard, systems and overall environment safety, the key safety challenge that still faces many organizations, and that needs further investigation and much required implementation support, and this is probably the key research theme for my module, is how these approaches as in a real-world set up can be moved beyond concept in safety protocol to really change the conditions and behavior at the shop-floor in real time in a dynamic operating environment and culture, as there is a large disconnect between theory and practice (Dodoo & Al- Samarraie, 2019). Therefore, the main objective of this systematic review is to bring together evidence from existing literature on a broad range of interventions, to offer some conclusions about the effectiveness of the interventions designed to improve occupational health and safety performance in industrial working environment, with a particular attention on the approaches that need more institutional attention and research investigation (Vitrano & Micheli, 2024). In particular, one of the key considerations in this review will be to focus on the most important aspect that determines the effectiveness of various already established health, safety and risk management systems in the organization.

This is how well these systems have performed in bringing the desired behavioral changes in the target workforce, as the efficacy of these systems will always depend on the effective implementation of the behaviors called for by such health and safety management systems in the organizations (Boyle, 2015). Additionally, for this review, I will be very critical of the

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various ways in which these studies have gone about not only measuring these outcomes but also in highlighting where current research stops in certain aspect from giving the complete picture of the relative effects of these interventions to the ultimate desired end (overall long term impact) as many a times, these assessments are not fully holistic and integrated.

Therefore, the study seeks to achieve the following objectives; a review of safety culture and risk management interventions designed to improve occupational health and safety performance, a focus on bringing out research gaps from the existing studies with a view to expanding and advancing the knowledge on best approach to developing a safety culture in any organization, critical appraisal of existing studies in term of how they go about measuring various aspects, and the establishment of a review framework for evaluating effectiveness of safety culture and risk management intervention that will be easy to apply and give a full and thorough picture of the issue at hand and the various gaps. This review will be further guided by the key relevant findings below. In recent years, there have been notable improvements in the policy and regulatory environment in relation to OH and SMM in the workplace, but there are still challenges in the context of preventing MSD (Yazdani et al., 2015). Many studies have shown that there is a need for more effective approaches, rather than just behavior modification methods (Wirth & Sigurðsson, 2008).

One of the main reasons for this is that even with appropriate regulations, there are still unsafe acts and behaviors like lack of knowledge about the job and its conditions, violations of safety rules and work pressure, which sometimes result from inadequate knowledge, violation of safety rules, work pressure and failure to use personal protective equipment, which are also related to individual factors, and unsafe behaviors were most commonly attributed to the system deficiencies, as well as the hazardous nature of the work environment (Dodoo & Al- Samarraie, 2019). On the other hand, a systematic review of the evidence on occupational safety and health interventions concluded that robust economic evidence was lacking for most interventions reviewed, especially at the organizational level, indicating the need for further research to establish their cost-effectiveness (Grimani et al., 2017). The overall evaluation of the impact of the safety interventions is further compromised by the inadequate knowledge of the relative effectiveness of various safety interventions, which constitute a major barrier to informed choice among decision-makers and users (Dyreborg et al., 2022).

This has also been recognized as a major need in a variety of reviews and evaluations of the evidence on the prevention of injuries in the workplace (Stout & Linn, 2002) (Pilbeam et al., 2019). In fact, based on what is known on the effectiveness of different safety interventions in real-life circumstances, there is a need to go beyond behavior change and cultural transformation as stand-alone and in isolation from other approaches to interventions in the industry (Nielsen et al., 2013). This is also due to the understanding of accidents and injuries as they manifest on the work system. As a starting point, one of the main applied approaches to the problem of injuries at work are drawn from what has been variously referred to as a sociotechnical system (STS) or systemic approach (Teufer et al., 2019) (Dyreborg et al., 2015).

The approach acknowledges that work-related injuries and illness is the result of an interplay between people, their organization and the wider work environment, as well as other external factors in their sociotechnical surroundings, and not just attributable to individual mistakes by

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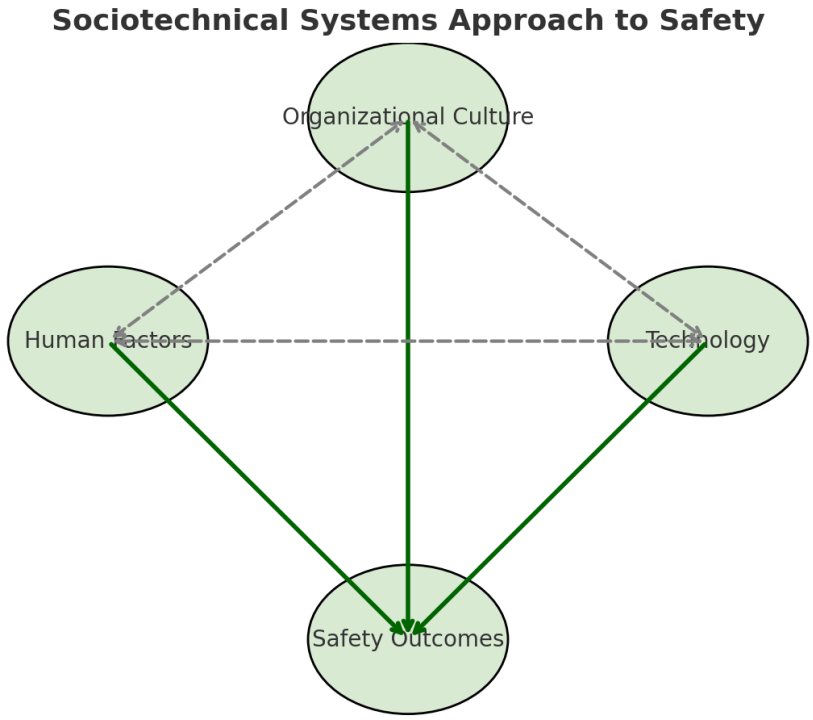
those who are directly at the "sharp end" (Carayon et al., 2015). It is also a recognition that traditional and usually fault-finding and blame-oriented enforcement mechanisms, can be usefully supplemented with methods derived from applied behavior analysis and the people based approaches to safety as in a situation where there is full engagement by the focus in identifying the hazards and behaviors as conditions rather than an after-thought in an investigation after an event/incident/accident (Geller, 2011). It therefore follows that an effective shift from purely reactive incident investigations to proactive identification and assessment of antecedents of unsafe behaviors and conditions requires a major paradigm shift as well as competencies at the 'front-line'. In addition, where traditional attempts at accident prevention have been most successful have been in the development and use of interventions not directed at just individual level change but group or organization levels, and this is a reason for an integrative approach (Dyreborg et al., 2022). This can be possible with an evidence-based integration of behavior change and cultural transformation approaches with scientific and more data-driven continuous and comprehensive approaches to problem solving (Nielsen et al., 2013).



Pictogram: Sociotechnical Systems Approach

A comprehensive sociotechnical systems approach also goes beyond just a compliance perspective. This approach facilitates the development of a more resilient safety culture by addressing the complex and interconnected factors that influence human performance and organizational outcomes (Rashid, 2024). It recognizes that effective safety management requires more than just following rules and regulations; it also fosters a proactive, adaptive, and continuously improving work environment that can anticipate and mitigate emerging risks (Robertson et al., 2015). It suggests that there are opportunities to do better than merely

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preventing events that may exceed the sum of the constituent risks (Ross et al., 2014) by employing a socio-physical approach to improve emergency response and preparedness significantly. Additionally, this approach acknowledges the challenges associated with designing large, complex systems and recognizes the importance of addressing the inherent limitations to enhance safety further (Alhajj & Rokne, 2018; Strauch, 2010; Afghan, 2022). In brief, it also underscores the influence of cultural factors on operational safety and reliability in sociotechnical systems, as well as their role in mitigating systemic failures.

Table 1: Comparison of Management Approaches and Their Impact on EHS and Operational Efficiency

Management Principle	Key Practices	EHS Benefits	Operational Efficiency Benefits
Lean Management	Waste reduction, process standardization, Kaizen (continuous improvement)	Reduces hazards by eliminating unnecessary steps; improves workplace organization (5S safety benefits)	Minimizes production delays, improves resource utilization, reduces costs
Total Quality Management (TQM)	Continuous quality improvement, customer focus, error prevention, team involvement	Enhances safety compliance through standardized processes and quality checks	Improves product quality, reduces defects, increases customer satisfaction
Safety Management Systems (ISO 45001)	Risk assessments, incident reporting, corrective actions, audits	Reduces accident rates, ensures compliance with safety regulations, builds preventive safety culture	Improves system reliability, lowers downtime, reduces insurance and compensation costs
Maintenance Management	Preventive and predictive maintenance, equipment reliability programs	Reduces equipment-related accidents, improves safety of operations	Enhances machine uptime, reduces breakdowns, lowers repair costs
Leadership Commitment	Visible safety leadership, resource allocation, safety communication	Builds strong safety culture, increases worker trust and compliance	Motivates workforce, improves morale, aligns workforce goals with organizational efficiency
Psychological Safety	Open communication, non-punitive reporting, team empowerment	Encourages reporting of near misses, reduces unsafe behaviors,	Improves innovation, fosters teamwork, enhances problem-

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		enhances employee well-being	solving and adaptability
Behavior-Based Safety (BBS)	Observation, feedback, reinforcement of safe behaviors	Reduces unsafe acts, improves worker accountability	Reduces absenteeism, improves productivity, sustains performance over long term

METHODOLOGY

The methodology for this literature review included the following stages. First, a systematic and iterative database searching process was conducted to identify and select relevant and up-to-date literature on the intersection of industrial management principles and their impact on EHS performance. Second, a critical appraisal and analysis were performed to extract key insights and evidence from the selected literature, focusing on how different aspects of industrial management contribute to or detract from occupational safety outcomes. Third, a thematic synthesis of the findings was carried out to identify common patterns, themes, and relationships between industrial management practices and safety metrics. This review also drew on interdisciplinary perspectives from fields such as organizational psychology, human factors, and risk management to provide a comprehensive understanding of the factors influencing EHS performance.

The methodology combines an experience-driven approach with a comprehensive literature review to ensure a holistic view of the subject. This approach allows for the identification of knowledge gaps and the development of a conceptual framework for understanding and improving industrial management's impact on EHS. The framework provides a systematic way of analyzing the causal relationships and feedback mechanisms between management decisions, operational processes, and safety outcomes (Aldoseri et al., 2024). Fourth, it also embraced a systems thinking perspective, acknowledging that single changes or interventions rarely result in significant or lasting improvements because of complex and interacting dynamics within an industrial system (Williams, 2013). Furthermore, this review has considered that failures in organizational and managerial functions, such as maintenance management, are critical drivers for plant safety and equipment reliability (Smith & Harris, 1992). The systematic review method used allowed for a thorough examination of both qualitative insights and quantitative evidence. By adopting this dual approach, the review ensured a more balanced and nuanced understanding of the effectiveness and impact of various management practices on safety culture and injury reduction (Ali et al., 2009). This dual approach also allowed for the identification of effective proactive safety actions and the development of methods and techniques for monitoring and responding to safety indicators before an incident occurs (Hallowell et al., 2013).

This involved a systematic review and characterization of the literature to identify and compare available indicators in safety management practices within utility industries (Ali et al., 2022). The review further explored the application and benefits of sensor-driven systems and Building Information Modeling in advancing safety management systems in this context (Asadzadeh et al., 2020). The consideration of how human factors and systems engineering

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tools and techniques can be leveraged to design a strong and sustainable quality management program also featured in the research.

This line of study has revealed that these tools are imperative for helping organizations optimize human performance in complex and dynamic work environments (Caldwell, 2008). The methodology has also considered evaluating safety barriers, which have increasingly been used for safety management as they can prevent the progression of an event and stop hazardous events or mitigate their consequences (Qiao et al., 2022). This type of approach moves the focus away from traditional safety considerations towards a more holistic view that includes the critical role of an organization, technology, and humans in ensuring workplace safety. This comprehensive research approach included a critical examination of proactive safety management practices and their value in industrial workplaces to prevent future incidents (Edkins & Pollock, 1996). The review of literature has also scrutinized the efficacy of different behavioral-based safety programs that have been used as methods for safety management and behavior shaping. This has been prompted by the rising cases of repeat safety events and fatalities caused by unsafe behavior in the industry (Hinai et al., 2019).

RESULTS

This part presents the results that emerged from the application of the above methodology, as well as the corresponding inferences and conclusions. This segment will describe how the reviewed literature can be utilized to operationalize industrial management concepts, thereby enhancing EHS performance effectively. This will be revealed through the study's findings of how factors such as leadership commitment, worker involvement, and continuous improvement practices significantly affect safety outcomes and contribute to a positive safety culture. In addition, the analysis has shown that the effective integration and implementation of safety management systems, including both lagging and leading indicators, is fundamental to continuous improvement and prevention of incidents (Elsebaei et al., 2020). Finally, the research has also found that making safety a core component of business operations and aligning it with the organization's goals and values can transform it from a compliance requirement to a strategic value driver that improves the overall performance and competitiveness of the company (Veltri et al., 2013).

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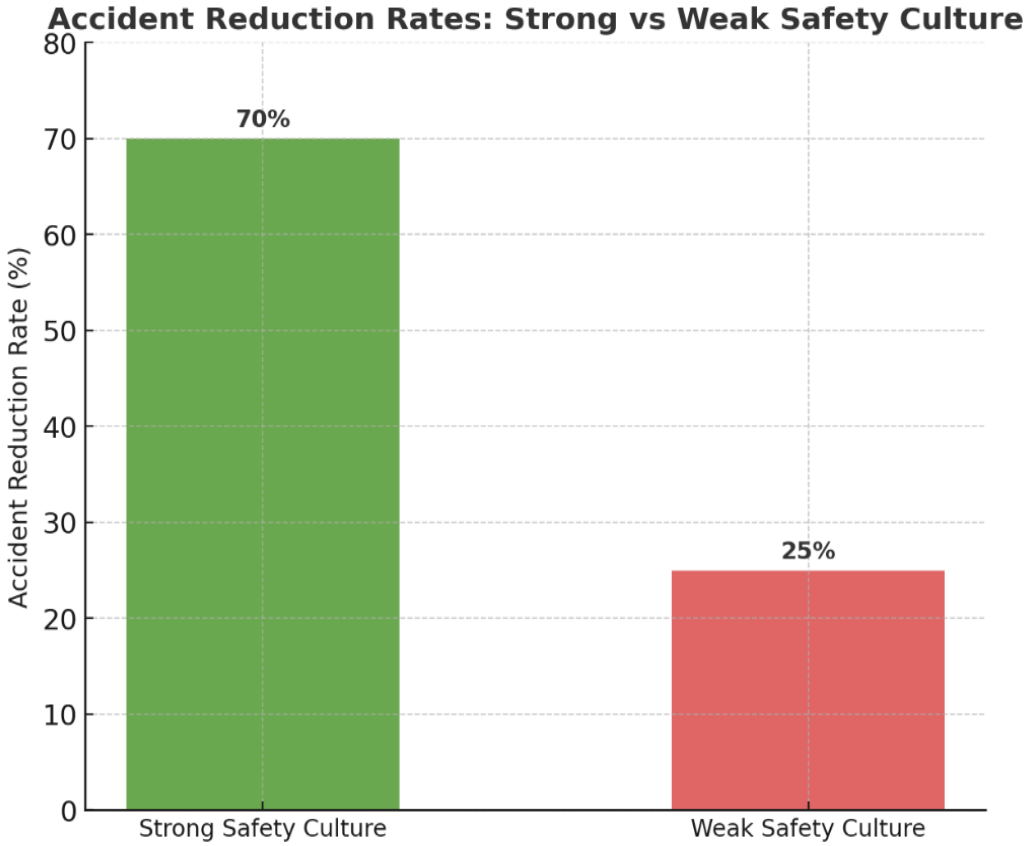

Bar Chart: Accident reduction rates in companies with strong vs weak safety culture

Results also revealed that product-oriented management competencies were significantly higher than safety-oriented management competencies, and this greatly affected job-related hazards and physical injuries (Tangkittipaporn & Tangkittipaporn, 2006). In my case, this would mean that, even though production aspects are important to meeting business targets, they can create problems. Safety-oriented management competencies can increase safety and become equal to product-oriented ones, which would result in greater EHS improvement. This finding would require a shift in thinking to change the way managers and workers are trained. It is necessary to invest time and resources in building and sustaining effective safety leadership. In order to achieve the necessary EHS performance, EHS must be considered as part of normal business decisions, and EHS components must be taken into account in management processes. (Muñiz et al., 2011) However, the results also show that a greater management commitment to safety and health through visible and effective communication could help develop and improve safety behavior, employee satisfaction, and competitive advantage of a firm. As per another study, management commitment is crucial in successfully implementing a Safety Management System (SMS) that is both sustainable and effective (Muñiz et al., 2007).

The constant support of management and employee participation has been directly linked to reducing injuries and fatalities (Muñiz et al., 2007). (Michael et al., 2005) Safety commitment

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has also been found to decrease occurrences of safety-related events, and simultaneously increase desirable employee attitudes and safety performance (Muñiz et al., 2011). Investing in sustainable development and improving safety can help an organization to balance business costs against social costs and can thus give the organization a competitive advantage in the long run (Maudgalya et al., 2008). This would mean that there is a business case for sustainable development and improved safety, and there is a benefit to it in terms of cost. This implies that economic impacts of EHS would be realized from a company's ability to effectively implement and enforce a robust SMS and, therefore, meet the social demand (Muñiz et al., 2008) (Muah et al., 2021). Also, as it was noted in the research, the critical part of a safety management system would be an individual's willingness to perform safety behaviors at work, and for that, a safety culture needs to be well established in a workplace (Azmi et al., 2014). This is because a positive safety culture can support performance through shared beliefs about the importance of safety, which are held by everyone in the company (Patwa & Moussa, 2018). Safety cultures have been described as a type of culture where employees have a safety mind-set.

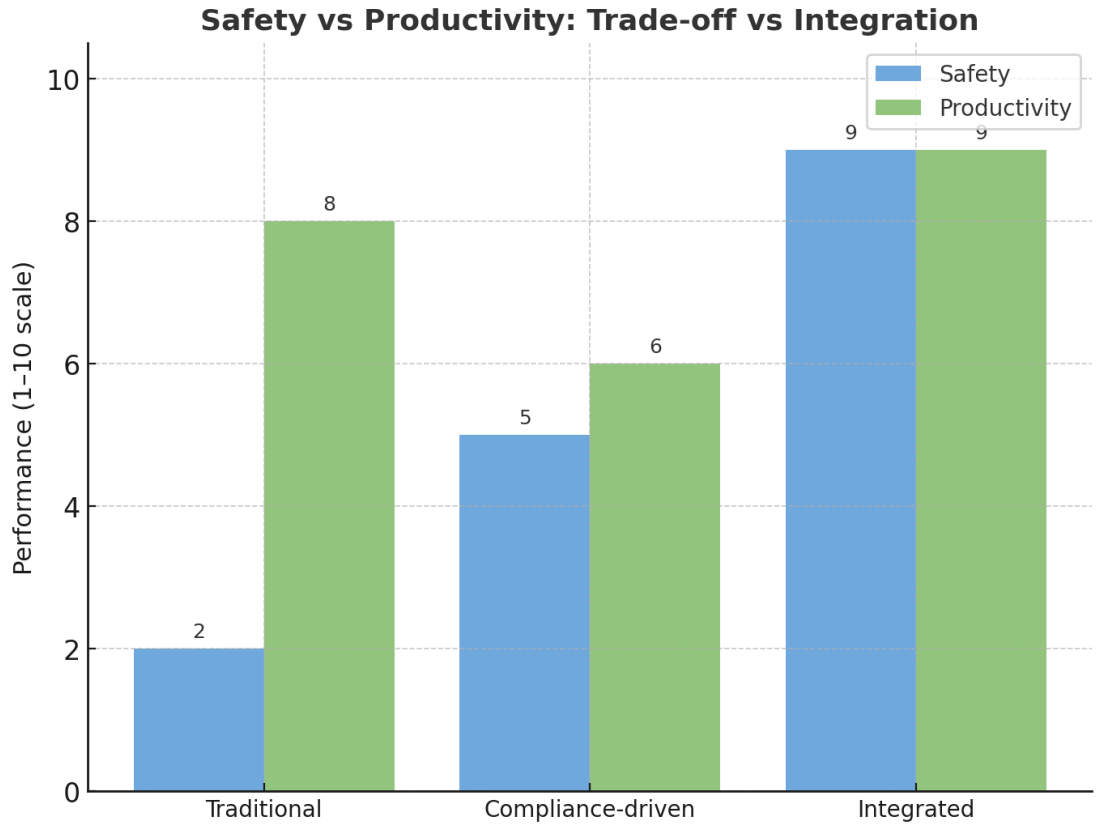

Chart: Safety vs Productivity Trade-off vs Integration

This is further reinforced by the presence of a strong safety leadership, which has been shown to be a key driver in improving safety performance and reducing occupational accidents and injuries in organizations (Adra et al., 2024). In addition, the active engagement of employees in safety activities, which is facilitated by effective communication and a supportive organizational climate, has been found to be a crucial component in building a proactive

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safety culture, where individuals are empowered to identify and report potential hazards (Featherly, 2008). This can lead to a positive feedback loop, where continuous improvement in safety practices is driven by feedback from all levels of the organization (Naor et al., 2020). In conclusion, the integration of industrial management principles with EHS strategies, which emphasizes hazard and risk management, not only contributes to the reduction of incidents and costs, but also plays a crucial role in building a resilient safety culture that values safety as an intrinsic organizational value (Bautista-Bernal et al., 2023). This includes the implementation of comprehensive safety management systems that prioritize learning and adaptation to emerging environmental risks (Nikolić et al., 2020).

These adaptive systems are essential for managing the increasing complexity of occupational risks and ensuring long-term efficiency (Smith, 2007). The strategic integration of these principles has been found to result in a strong safety culture, which leads to improved safety performance by positively influencing staff behavior and encouraging proactive risk management (Luther & JOHNSON, 2008). This cultural shift effectively transforms safety from a reactive compliance-driven practice to a proactive value-adding operation, resulting in a positive impact on overall organizational resilience and competitive advantage (Buell, 2006). This comprehensive approach also goes beyond simple regulatory compliance, deeply embedding safety as an inherent and inseparable component of operational excellence and strategic planning (Ghorbani et al., 2024). This integrated perspective is aligned with the concept that safety culture, which is defined as the shared beliefs, perceptions, attitudes, and behaviors of individuals and groups regarding safety within an organization, plays a critical role in reducing high-consequence incidents and improving overall EHS performance (Lakhiani et al., 2016).

This is because a strong safety culture enables open communication and non-punitive error reporting, which are key elements of organizational learning and continuous improvement in safety (Ulmer et al., 2009). This proactive approach is also critical in promoting an environment where every individual is responsible for their own safety as well as that of others around them, as opposed to the common misconception that safety is the sole responsibility of the management (Al-Kudmani, 2008). Indeed, promoting this kind of culture also requires moving away from an adversarial relationship between employees and management, and the building of trust and respect to ensure that safety control measures achieve the desired outcome of improved safety performance (Page, 2004). This approach to safety management, which is often referred to as Total Safety Management, integrates all the psychological, behavioral, and managerial factors that contribute to the ever-increasing high number of casualties and illnesses observed in many industrial operations today (Ayinde & Damilare, 2018).

This holistic framework, which gives primacy to a human-centered approach to safety, also posits that both employee engagement and the presence of a supportive organizational climate are crucial in the prevention of accidents and the overall improvement of safety performance in many industrial operations (Wachter & Yorio, 2013). This integrated strategy also postulates that a strong safety culture, which is reflected in the belief that safety is a core value that is embraced and promoted by the organization, is associated with a reduction in the perceived level of risk among workers and improved safety performance (Irshad et al., 2021) (Moraru et al., 2020). This positive association between safety culture and safety

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performance also underscores the important role that strong leadership plays in not only establishing an organizational climate where safety is prioritized and actively promoted, but also in continuously reinforcing and embedding safety as an integral component of all organizational operations (Abeje & Luo, 2023).

This, therefore, requires that safety management is seen from a strategic perspective, where top management plays a critical role not only in the design and development of safety strategies but also in their implementation and evaluation (Zou & Sunindijo, 2015). This also includes establishing a climate where employees are not only encouraged but also empowered to actively engage in the identification of potential hazards as well as the proffering of recommendations for improvement, as they are often the ones on the ground and are likely to have first-hand exposure to the day-to-day operational realities (Templeton, 2014). This requires a fundamental shift from a reactive incident-response approach to a more proactive risk-prevention model, where data is used to inform continuous improvement efforts and predictive analytics are leveraged to anticipate and mitigate potential risks before they manifest into incidents (Clare & Kourousis, 2021). This approach, which is supported by the demonstrated commitment of top management, significantly reduces the frequency and severity of incidents, and is, therefore, critical for the well-being of workers as well as sustained organizational performance (Griffiths, 1985).

This proactive safety management is also congruent with the concept of Safety Management Systems, which provide a systematic approach that organizations can use to manage their safety risks in a way that leads to continuous improvements in safety performance (Blišťanová et al., 2021) (Banda et al., 2016). Such systems often include well-articulated safety policies and robust risk assessment mechanisms, as well as clearly defined roles and responsibilities and ongoing monitoring and evaluation processes to ensure compliance and effectiveness (Al-Bayati & Chellappa, 2025). These systems also rely on active employee involvement and positive safety perception, which together make up what is often referred to as the safety climate (Castro et al., 2025). The safety climate, which captures employees' shared perceptions of the organization's safety policies, procedures, and practices, is therefore critical as it has a direct impact on individual safety behavior and, by extension, safety outcomes (Muñiz et al., 2006). Research has shown that a positive safety climate is associated with lower accident rates and, therefore, better safety performance (Jiang & Probst, 2015). The development of a robust safety management system also influences employee involvement and participation in safety activities, with managerial commitment playing a critical role in this dynamic through the provision of the necessary resources (Muñiz et al., 2007). In addition, this engagement fosters a sense of psychological safety among employees, where they feel empowered to actively contribute to the identification of hazards and the continuous improvement of organizational safety (Piao & Hahn, 2025).

This is further reinforced by leadership behaviors that explicitly promote safety activities and recognize and reward proactive safety participation, which serve as important motivators for employees to not only take ownership of their safety responsibilities but also to identify and report potential risks before they lead to incidents (Curcuruto et al., 2019). This is also an environment where employees can freely raise safety concerns without fear of retribution, which significantly improves information sharing and collaboration (Mogård et al., 2022). This creates a culture where individuals feel empowered to take interpersonal risks,

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such as speaking up against unsafe practices or suggesting improvements, which is critical for the overall effectiveness of an organization and safety (Eldor et al., 2023) (Mogård et al., 2022).

On the other hand, the lack of psychological safety in a working environment can have a chilling effect on communication, leading to innovation and learning stagnation, which, in many cases, results in underreporting of incidents and a lack of motivation to challenge established unsafe norms, and this can, in turn, negatively impact safety performance (Eldor et al., 2023). Indeed, the absence of a psychologically safe environment can leave organizations with blind spots when it comes to hazards and vulnerabilities, which has a direct negative impact on an organization's learning and adaptation abilities in safety-critical situations (Lenberg & Feldt, 2018). This term, first coined by Schein and Bennis way back in 1965, has recently received much-needed attention in organizational research for its role in teamwork, reducing stressors, and promoting learning and innovation (Ip et al., 2025).

Kahn later revisited the term in the 1990s, defining psychological safety as the feeling of being safe and confident that people have when navigating change (Edmondson & Lei, 2014) (Alami et al., 2023). Subsequent research, however, has built on this work and refined this definition to the more commonly accepted concept today of a shared belief that a team is safe for interpersonal risk taking, which is critical for creating open communication and effective error reporting in high-risk industries (Edmondson & Lei, 2014). This shared belief, which encourages individuals to speak up, share ideas, and admit mistakes without the fear of negative consequences, is crucial in improving learning and, by extension, proactive risk mitigation (Alami et al., 2023) (Patil et al., 2023). This, therefore, allows for continuous improvement, where lessons learned from near misses and incidents are shared and discussed, and implemented as part of revised safety protocols and procedures for better overall organizational resilience (Edmondson & Lei, 2014). This is because psychological safety is defined as the perception individuals have on the consequences of engaging in interpersonal risks within a given context (Edmondson & Lei, 2014).

In this case, the context is the workplace, and this perception, therefore, significantly influences an employee's willingness to openly participate in safety-critical discussions, report potential hazards, or make suggestions for improvement without the fear of embarrassment or punishment (Ito et al., 2021). This, therefore, creates an environment that is more conducive to individuals freely admitting errors and proffering solutions, which is particularly critical for organizational learning and the prevention of major catastrophes in high-risk industries (Opoku et al., 2019). It creates a growth mindset, where individuals are willing to take the necessary risks for their optimum performance and in an environment where they are not afraid to speak up and share their ideas or ask questions (Dong et al., 2025). This culture of openness, therefore, has a direct impact on the improved EHS performance of an organization as it actively encourages the early identification and remediation of safety deficiencies (Edmondson & Lei, 2014) (Edmondson & Bransby, 2022).

DISCUSSION

Psychological safety also empowers individuals to overcome the anxiety that may be associated with admitting shortcomings and enables an environment where mistakes can be

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admitted and learning from failure is the norm, which, in turn, leads to better decision making (Sapra & Kumar, 2020).

This, therefore, provides employees with a sense of psychological protection, which allows them to freely develop their skills, obtain critical information, and meaningfully contribute to their work environment without any fear of negative consequences to their image or status (Jindal et al., 2024) (Zhang et al., 2023). This, therefore, leads to an employee proactively engaging in EHS activities, as they are more likely to report near misses as well as embrace continuous improvement initiatives (Dietl et al., 2023). This also translates to psychological safety being directly related to better communication and coordination within teams, which is critical for effective hazard control and emergency response protocols (Edmondson & Bransby, 2022). It also plays a critical role in enabling innovative problem-solving and adaptive behavior in the face of unexpected challenges, which, in turn, allows organizations to quickly pivot in dynamic operational environments. Indeed, research has found a link between psychological safety and enhanced team effectiveness, as well as improved individual work engagement, which ultimately leads to more creative and responsible employees (Mogård et al., 2022) (Li & Peng, 2022). The presence of psychological safety within an organization is also associated with a reduction in employee turnover and absenteeism, as workers also feel valued, supported, and motivated to stay in a positive work environment (Quansah et al., 2023).

This ultimately leads to a culture of continuous improvement in EHS, as employees are likely to proactively engage in safety activities as well as contribute to organizational learning (Patil et al., 2023) (Hunt et al., 2021). It also fosters a sense of collective responsibility, where every employee is actively involved in risk identification and mitigation activities, which leads to a more robust and resilient safety culture (Edmondson, 2003). This critical element of psychological safety is, therefore, key for creating an environment where employees are willing to voice their opinions, share their ideas, and challenge the status quo without fear of negative consequences, thereby facilitating authentic engagement and deeper relationships in the workplace (Paulus, 2023).

Table 2: Role of Psychological Safety in Enhancing EHS and Organizational Performance

Psychological Safety Element	Effect on Safety Outcomes	Effect on Organizational Performance
Error Reporting	Encourages early reporting of hazards and near-misses, reducing accident likelihood	Provides more accurate data for decision-making, enabling proactive risk management
Team Trust	Builds mutual accountability and vigilance, lowering unsafe acts	Strengthens collaboration, improves communication, and enhances team cohesion
Employee Empowerment	Promotes active participation in hazard identification and safety initiatives	Increases job satisfaction, engagement, and innovation
Non-Punitive Environment	Prevents fear of retaliation, leading to transparent sharing of safety concerns	Reduces turnover, fosters loyalty, and encourages open problem-solving

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Leadership Support	Reinforces safety culture through role modeling and resource allocation	Improves morale, builds confidence in management, and aligns safety with organizational goals
Open Communication	Enhances flow of critical safety information across all levels	Supports adaptability, knowledge sharing, and continuous improvement
Learning from Mistakes	Transforms incidents into opportunities for preventive action and safety protocol improvement	Fosters resilience, drives innovation, and ensures long-term competitiveness

Team psychological safety facilitates effective teamwork, leading to improvements in health, safety, and environmental performance (Patil et al., 2023). Furthermore, the mutual trust and shared norms established within psychologically safe teams enable them to work together and actively support one another. Psychological safety at the team level is described as a general atmosphere within the team that promotes interpersonal risk-taking. This is where employees feel safe enough to raise their concerns, opinions, and questions, and even make mistakes without fearing backlash or adverse consequences to their image, status, and career (Zhang et al., 2023). The difference between psychological safety at the individual and team levels is considered an important distinction (Kim et al., 2020). Psychological safety is considered to have a significant influence on teams' functioning, learning, efficacy, and performance. It also makes it possible to reveal the prerequisites of successful teamwork in today's organizations (Patil et al., 2023). Research also shows that psychological safety has a positive effect on team performance, efficiency, and learning. It is not only the absence of fear or trust but also supports innovation and enables error prevention (Alami et al., 2023; Grailey et al., 2021). It also creates a greater willingness to engage in productive team conflict and disagreement (Sapra & Kumar, 2020).

Leadership behavior is therefore associated with the development of the team's safety culture. This directly impacts their safety performance through its effect on workers' safety motivation and adherence to safety management systems and procedures (Hunter et al., 2019). Leaders who establish trust, communicate openly and honestly, and express support and empathy help to develop an environment of psychological safety for employees (Swain et al., 2024). In other words, effective leadership behavior, which directly affects the establishment of psychological safety, is characterized by the leader's openness, availability, and accessibility (Wang et al., 2022). Psychological safety also contributes to organizational learning and adaptation to new environmental, health, and safety challenges and opportunities. The absence of psychological safety, on the other hand, can have negative consequences for organizational learning and the ability to adapt to changes. A lack of psychological safety can reduce communication and knowledge sharing, which are necessary for successful organizational learning and adaptation to change (Itzchakov & DeMarree, 2022) (Ip et al., 2025). It can also hinder the ability to develop psychological safety and be ineffective in building and maintaining relationships with team members (Wouters-Soomers et al., 2022). This can lead to increased stress and eventually burnout in employees, which is

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also associated with poorer EHS performance (Lisser et al., 2024). The absence of psychological safety, at the individual and team levels, can also lead to moral distress and psychosomatic problems (Laird et al., 2024). This can be particularly common for faculty, trainees, and students, as well as underrepresented groups, in health and safety contexts. It is also important to note that psychological safety, as an effective safety management strategy, is considered to be of particular importance in managing diverse teams (Edmondson & Roloff, 2008).

This is due to the fact that psychological safety is known to reduce the potentially negative impact of diversity on team processes and performance (Edmondson & Roloff, 2008). It is possible to communicate effectively and overcome the barriers and limitations of diversity when psychological safety is provided. This is very important for safe and efficient production processes in organizations with a diverse workforce (Edmondson & Roloff, 2008). Psychological safety is also important for organizations to help team members establish connections with each other. In particular, it is an important factor for people to feel included and respected and to work in the team (Wouters-Soomers et al., 2022). In this way, psychological safety is associated with high team performance (Wouters-Soomers et al., 2022). The importance of psychological safety can be understood as a necessity for successful health and safety management, especially in highly complex operational settings. In summary, this concept can be seen as a resource that organizations should consider and apply for optimal health, environment, and safety performance. This because it underpins an effective safety culture and management, going beyond lagging indicators of safety, as well as important workers' psychological health and well-being. As a result of the absence of psychological safety, there is also the likelihood of emotional fatigue in workers (Lintanga & Rathakrishnan, 2024).

This eventually can lead to the emergence of stress and mental health disorders (Lintanga & Rathakrishnan, 2024). It can be also assumed that employees should work in a safe environment where they feel safe. If employees think they have sufficient resources to cope with challenges, they will be able to prevent emotional exhaustion and stress (Zhou & Chen, 2021). It is emphasized that psychological safety can help predict productivity, in the sense that employees who feel psychologically safe at work are more engaged and more willing to take risks in decision-making for the benefit of efficiency and innovation (Grailey et al., 2021). In other words, when psychological safety at work is high, people can be more focused on their work and take intelligent risks for better organizational outcomes (Grailey et al., 2021). In the light of the latter, a positive relationship between psychological safety and environmental, health, and safety performance can be hypothesized. This direct relationship can be explained by the fact that taking intelligent risks for the good of the organization can directly lead to better EHS results.

A proactive attitude to problem-solving, supported by a good organizational climate, allows for risk management at an early stage, while early reactions can already mean the elimination of this risk. In a similar way, in environments with high psychological safety, EHS is likely to be higher due to better innovative performance in organizations (Wang & Ning, 2024). Workers are more likely to accept and encourage thoughtful risk-taking behaviors to drive innovation and achieve better outcomes for themselves and organizations (Araslı et al., 2020). This suggests that employees will be more likely to support and encourage each other

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to improve the EHS performance of their organization. It is also associated with more active workers' self-compassion (Wouters-Soomers et al., 2022). It is considered to be important for EHS performance in the periods of uncertainty and major change (Wouters-Soomers et al., 2022). In this way, by reducing employee stress and burnout, a psychologically safe workplace can have a direct impact on the well-being of employees (Wang et al., 2022).

Therefore, the next step in the development of the relationship between psychological safety and EHS is to prevent psychosocial risks in the workplace, contributing to a favorable psychological environment for workers (Wang et al., 2022) (Idris et al., 2011). This is due to the fact that in the absence of psychosocial risks, employees can feel safe, able to express themselves freely, and be a full member of the team in the workplace (Hallam et al., 2023). This increases the likelihood of being able to openly express ideas and ask questions without fear of sanctions (Hallam et al., 2023). In this situation, team members are more likely to put the success of the team and the organization before their own personal success (Hallam et al., 2023). An important benefit is that psychologically safe teams are also more willing to report errors and near misses without fear of punishment (Kim & Kim, 2020) (Hallam et al., 2023). This directly affects the quality of data for risk assessment in the future and the success of measures to prevent their occurrence. In this way, by encouraging team members to talk about vulnerabilities and mistakes, psychological safety can turn them into learning opportunities (Jin & Peng, 2024).

It is also pointed out that psychological safety in the workplace, in this context, directly contributes to EHS performance (Hunter et al., 2019). This is due to the fact that health, safety, and environment performance at the operational level is highly dependent on work organization and working conditions, which are in turn closely related to the professional and personal psychological climate of employees (Hunter et al., 2019). A direct consequence of good safety culture, psychological safety has gained increasing importance in health care organizations and other high-risk industries in recent years (Hunt et al., 2021) (Ip et al., 2025). This is associated with the greater impact of worker errors in these sectors on harm and, for example, patient safety.

Table 3: Key Findings & Practical Implications

Key Finding	Practical Implication
Safety integration improves competitiveness	Managers must align safety with production goals to achieve both efficiency and sustainable growth.
Leadership commitment is critical for robust safety culture	Senior management should demonstrate visible safety leadership and allocate resources consistently.
Employee engagement enhances reporting and learning	Organizations should empower workers to participate actively in hazard identification and corrective measures.
Psychological safety fosters proactive communication and innovation	Build a non-punitive reporting culture to encourage openness, collaboration, and continuous safety improvement.
Balanced focus on productivity and safety reduces workplace risks	Avoid prioritizing short-term output at the expense of safety; integrate EHS into operational

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	KPIs.
Strong safety management systems lower accident rates and costs	Invest in ISO 45001 and similar systems to institutionalize preventive safety measures and reduce financial losses.
Continuous learning from incidents drives long-term resilience	Implement feedback loops from incidents and near misses into training and process improvement.
Sociotechnical integration (people, culture, technology) enhances safety outcomes	Use a systems approach that combines human factors, organizational culture, and technology for effective EHS.

CONCLUSION

This point is crucial because a culture of psychological safety is believed to be a precondition for open communication, rapid learning from events, and ultimately, for a reduction in medical errors in complex environments (Hunt et al., 2021; Montgomery et al., 2025; Grailey et al., 2021). This principle can be applied directly to industrial settings, where the relationship between human factors and complex equipment can be improved if everyone, from management to workers on the shop floor, feels confident that they can raise a concern without fear of reprisal (Hunt et al., 2021). This kind of environment is ideal for spotting potential risks and preventing them proactively, and is therefore likely to have a direct impact on the EHS performance in these settings.

Psychological safety needs to be integrated with the overall EHS system of an organization to ensure continuous improvement and that everyone in the company reports any issues, working together to solve them (Gibson et al., 2017). This approach has the potential to not only address risks more effectively but also to build a nimble EHS system that can adapt to the changing requirements and challenges posed by its operations. This means that psychological safety can transform EHS from a compliance-based burden into a strategic advantage, enabling organizations to achieve better safety outcomes while also enhancing productivity and innovation (Hunt et al., 2021). This can make an organization more resilient and able to cope with complex problems and be less likely to be interrupted by safety issues. By prioritizing psychological safety, an organization is more likely to cultivate an EHS culture that prevents incidents and promotes employee well-being, which can also lead to a happier and more productive workforce (Sapra & Kumar, 2020; Ito et al., 2021). This kind of integration can change the way EHS is typically viewed, shifting from merely fulfilling regulations to a more preventive and people-centered approach to risk management.

This helps an organization not only better protect itself from potential risks but also to create an environment where employees can be more innovative, which is likely to lead to improved operational performance and make the company more competitive in the long run. This approach also has benefits, such as helping an organization meet and even exceed its safety performance requirements, as well as enabling a more productive workforce. This demonstrates that psychological safety is essential for an agile and responsive EHS system, as it enables an organization to have a system where learning and proactive risk prevention are integral to daily operations (Kwon et al., 2020). This is likely to allow employees to be much

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more engaged with safety and have an organizational culture that results in many fewer incidents and a much better overall performance (Edmondson & Lei, 2014) (Ito et al., 2021). This is because if people are encouraged to take risks with interpersonal relations and feel that they are safe to do so, they are more likely to learn and improve their behavior and this has the benefit of being much more innovative (Andersson et al., 2020). This can also allow an organization to challenge the status quo and have a greater number of suggestions and feedback, which is important if an organization is to remain innovative and be successful in the long term (Negara et al., 2023). This can make an organization much more agile and resilient and be able to deal with many more challenges, both those which are unforeseen as well as to take advantage of any opportunities (Nikolić et al., 2020). This is important as it is likely to result in higher engagement and an environment where people feel that they are accepted, which is an important part of making sure that employees feel that they can be as involved as possible in order to be able to contribute to the organization as a whole (Wowor & Dewi, 2022). This is because the Psychosocial Safety Climate is a way of an employee's shared perceptions about the value and priority that management gives to psychological health and safety in the workplace, which is an important part of the work environment which can have a direct effect on job demands and job resources (Amoadu et al., 2025). The more management shows their commitment to the psychological safety of an employee, the more likely it will be to show their job satisfaction, as well as the fact that the better this kind of communication, the lower the amount of absence an organization is likely to experience (Lintanga & Rathakrishnan, 2024). This means that the more an organization is likely to have a better psychological safety, the more creativity and innovation it is likely to see, as well as much lower numbers of workplace incidents (Zadow et al., 2023). This is also the case as a strong psychological safety climate will have a direct effect on the performance of a team as a whole because it is likely to lead to much more diverse input from many different people, which is essential in the event of finding a creative solution to a problem (Kim et al., 2020). Furthermore, a strong sense of psychological safety will also likely lead to employees being much more willing to report potential hazards as they are much more likely to share any information they have regarding near misses and deviations, as well as stop unsafe acts. This psychological safety also allows organizations to be able to learn more from any failures they may experience, which is a must for them to be able to improve (Nejati & Shafaei, 2023). This kind of organizational climate that people perceive to be a safe place for interpersonal risk-taking behavior is likely to have a direct impact on an organization's ability to be radically innovative as well (Andersson et al., 2020). This is important for any high-reliability organizations as the ability to freely share any suggestions, even if they are viewed as controversial, may be key to ensuring that such an organization can function and avoid many major system failures (Imran et al., 2025) (Ghafoor & Haar, 2020). This ultimately shows that by encouraging people to feel safer psychologically, an organization can have a much-improved EHS performance as measured by rates of incidents as well as days lost, which is important for any organization's safety culture.

This indicates that a strong and effective psychosocial safety climate is a significant predictor of higher work engagement, as well as creativity and innovation, all of which are crucial for enhancing an organization's performance and justifying the business case for implementing one (Zadow et al., 2023). This is why the leadership of an organization is likely to be a

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deciding factor in how strong the PSC of an organization will be, because they are the ones who will show whether or not they care about the well-being of an employee, which will have a direct impact on the EHS performance of an organization as a whole (Amoadu et al., 2024). This is because if an organization's management makes it clear that they value the PSC, the EHS will no longer be just another burden, but will become a much more integral part of their values and beliefs (Gladka et al., 2022). This is crucial for an organization because by taking such an approach, the PSC will allow it to be much more sustainable and competitive in the long term, by building a culture that is geared toward continuous improvement and a proactive management approach to risks. This type of system also highlights the mediating role of learning behavior, as well as its efficacy in translating psychological safety into performance. This is important because it indicates that the new safety system is not only likely to be followed but also to be more proactive (Kim et al., 2020). This also creates a better link between EHS and the rest of the operations, making it no longer seen as an initiative on its own, but rather one that is more intertwined with the daily work of the entire organization. This creates a positive feedback loop in which the information gained from EHS performance is likely to feed back into the overall operations strategy, thereby helping it to improve continuously.

This is key to ensuring that an organization can adapt to any changes and meet all the requirements necessary for operation, by strengthening both its safety performance and overall organizational resilience (Andersson et al., 2020). This is key, as it changes the EHS approach from being a reactive cost center to one that can drive innovation and, therefore, give an organization a strategic advantage in the complex industrial system it operates in. This is also important, as it is based on the understanding that an organization's employees are more likely to feel safer when a certain level of psychological safety is in place (Quansah et al., 2023). This is a proactive culture that will be much more effective in preventing many different types of risks as well as improving the operational performance of an organization by reducing the number of disruptions as well as making the workforce more content, which is key to any organization (Bautista-Bernal et al., 2023; Buell, 2006; Moraru et al., 2020). The commitment of an organization to its employees ' well-being and safety needs to be a strong one and visible at all levels within the organization, as this will enable its leaders to gather more knowledge from different departments to improve safety (Naor et al., 2020). This is why employees need to be engaged in the EHS initiative by using a human performance-based safety management system, as this approach will not only have a positive effect on an organization's culture but will also be more effective in preventing incidents (Wachter & Yorio, 2013). By making psychological safety a priority, an organization cannot only achieve a more positive EHS performance but also view it as a strategic advantage, rather than just an added compliance measure, to significantly improve the well-being of workers and operations overall (Kim et al., 2020).

This represents a shift from a reactive approach to safety, which is crucial because many major accidents and disasters have been found to have had poor safety culture as one of the underlying causes of such events (Luther & Johnson, 2008). This suggests that further research is necessary to establish the precise relationship between an organization's safety culture and its capacity to operate safely, as it is widely acknowledged that a robust safety culture is a crucial component of an effective organization (Muñiz et al., 2007; Patwa &

Moussa, 2018). This is important because by taking such a proactive approach, an organization is likely to create a culture where safety will be a shared value and responsibility, instead of something that is imposed from the top, and as a result, should be more geared toward continuous improvement and emphasizing employee empowerment (Azmi et al., 2014; Featherly, 2008). This will involve a concerted effort to integrate safety into the daily operations of an organization, as this will not only make it a more theoretical concept but also turn it into one that is applied in practice (Rusyda & Aziz, 2021). This will enable an organization to have a significantly more effective safety culture, which has been demonstrated to be crucial for various aspects, including an organization's productivity and even its profitability (Azmi et al., 2014). The way in which such a safety culture is built will focus not only on safety behaviors but also on occupational safety, as well as process safety, with the former being about protecting individual employees and the latter about limiting the risks associated with various hazardous processes (Lakhiani et al., 2016). This enables an organization to have a more robust risk management system, one that can address not only acute risks but also chronic hazards.

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