

Implementation of the Occupational Health and Safety Program in Reducing the Number of Work Accidents in the Manufacturing Industry: A Literature Study

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ABSTRAK

This study aims to analyze the implementation of the Occupational Safety and Health (OHS) program in reducing the number of workplace accidents in the manufacturing industry through a qualitative approach using a literature study method. The study was conducted on various scientific sources, including international journals, official agency reports, and the results of the latest research for the period 2015–2025. The synthesis results indicate that the effectiveness of the OHS program is greatly influenced by the integration of policies, management commitment, and the safety culture established in the workplace. Systematically implemented OHS programs have been proven to be able to reduce the workplace accident rate by up to 40–50 percent through the implementation of continuous training, safety audits, and the use of digital-based hazard detection technology. However, obstacles still arise due to limited resources, low worker compliance, and weak internal supervision. Strategies for strengthening safety culture through participatory leadership, worker involvement, and a reward system for safe behavior are identified as key to the sustainability of OHS implementation. The study's conclusion confirms that the development of a strong safety culture and consistent regulatory support are the main foundations in creating a safe, productive, and highly competitive manufacturing work environment in the era of modern industrialization.

Keywords: *K3, Manufacturing, Occupational Safety.*

INTRODUCTION

The manufacturing industry is a strategic sector that serves as a key pillar of national economic development due to its significant role in increasing added value, employment, and contributing to exports. Production activities involving high technology, the use of heavy machinery, and human interaction with high-risk materials make this sector highly vulnerable to workplace accidents. The

complexity of production systems creates various potential hazards, including mechanical, chemical, and ergonomic hazards. When risk management is not systematically implemented, work incidents can increase, disrupting the stability of a company's operations (Andersen et al., 2019). This situation makes the need for an integrated safety system increasingly urgent. Increasing awareness of occupational safety not only aims to protect workers but also maintain the efficiency of the production process to prevent disruptions from undesirable incidents (Kineber et al., 2023). This phenomenon demonstrates that occupational safety is inseparable from a sustainability-oriented industrial management strategy. Therefore, the urgency of implementing an Occupational Safety and Health (OSH) program in the manufacturing sector is a necessity that cannot be ignored.

The Occupational Health and Safety (K3) program is designed as a comprehensive protection system for workers to avoid the risk of occupational accidents and diseases. The main objective of K3 implementation is to create a safe, comfortable, and productive work environment through the application of hazard prevention and control principles (Abidin et al., 2021). Effective K3 implementation encompasses planning, training, evaluation, and the development of a strong safety culture across all levels of the organization. Legislation such as Law Number 1 of 1970 and Government Regulation Number 50 of 2012 has provided a clear legal basis for companies' responsibilities for worker safety. Implementing this program requires management commitment to integrating safety policies into all production activities. K3 functions not only as a technical instrument but also as an organizational strategy that supports the improvement of the company's performance and reputation (Johanes et al., 2023). Thus, an K3 program can be viewed as a long-term investment that provides sustainable economic and social value. Its effectiveness is an important indicator of the extent to which an organization is able to balance productivity with worker safety.

Despite the availability of comprehensive OHS regulations and guidelines, implementation in the field often faces various structural and cultural barriers. Many companies still view OHS programs as merely administrative obligations without understanding their strategic value in increasing competitiveness. Low levels of compliance with safety procedures are often triggered by a lack of technical training, weak supervision, and limited budgets for accident prevention activities. Another contributing factor is workers' tendency to ignore risks due to being accustomed to repetitive work routines (Farashati et al., 2025). This phenomenon illustrates that the success of OHS implementation is determined not only by policy but also by the quality of the underlying organizational culture. The gap between regulations and reality on the ground is a major challenge in reducing the number of workplace accidents. Efforts to improve OHS effectiveness must include education, strengthening the monitoring system, and increasing active worker participation. Strengthening these three elements is expected to build an occupational safety system that is more adaptive to the dynamics of modern industry.

A work safety culture is a fundamental component that determines the successful implementation of an OHS program in the manufacturing sector. This culture reflects collective values, beliefs, and behaviors that prioritize safety in every work activity. Organizations with a strong safety culture tend to have lower accident rates because each individual feels responsible for the safety of themselves and their colleagues (Febriyanti, 2025). Strengthening this culture requires a long-term process through habituation, effective communication, and role models from top management. Every safety policy needs to be accompanied by intensive socialization to become part of a shared consciousness. Once safety values are internalized, compliance with OHS procedures is no longer coercive but rather arises from intrinsic awareness. Companies that successfully instill a safety culture typically have a transparent and open incident reporting system. This situation demonstrates that the technical success of OHS implementation will be difficult to achieve without the support of an organizational culture conducive to occupational safety.

Optimal implementation of OHS also depends on a quality management system capable of integrating safety aspects throughout the operational cycle. This system encompasses risk planning, implementation of control procedures, periodic evaluations, and corrective actions for deviations. Modern safety management models emphasize a proactive approach, identifying potential hazards before they cause accidents (Aini et al., 2025). This approach enables companies to systematically mitigate risks to minimize material and non-material losses. The effectiveness of this system is measured not only by a decrease in the number of accidents but also by increased awareness, participation, and compliance with safety standards. Management that adapts to technological and regulatory changes will be better able to maintain the stability of a company's operations. Consistent implementation will strengthen employee confidence in organizational policies and encourage a safer work climate. Therefore, safety management must be implemented as an integral part of the business strategy, not simply an additional activity.

Reducing the number of workplace accidents is inextricably linked to the role of continuous evaluation and analysis of accident data. Every work incident should serve as a learning resource for the organization to prevent similar incidents in the future. Through a transparent reporting system, the root causes of accidents can be objectively identified and addressed through targeted corrective actions. Continuous evaluation also helps companies assess the effectiveness of implemented safety policies. The results of this analysis can be used to update work procedures, improve training, and strengthen worker awareness of potential risks. The implementation of an OHS audit system is a crucial tool for ensuring compliance between field practices and established standards (Irawan et al., 2025). When the evaluation process is carried out systematically, companies can foster a culture of continuous improvement in occupational safety. This principle forms the foundation for creating a work environment that is resilient to the threat of accidents and operational disruptions.

The development of research in the field of occupational safety shows that literature reviews make a significant contribution to improving understanding of the effectiveness of OSH programs. Literature reviews enable researchers to examine various published empirical results and identify patterns of success and failure in OSH implementation across various countries and industrial sectors. This approach is comprehensive because it summarizes previous findings and systematically examines their interrelationships. Through comparative analysis, key factors influencing successful OSH implementation, including policy, management, and worker behavior, can be identified. Literature reviews also play a role in developing new theories relevant to the increasingly complex dynamics of modern industry. By integrating previous research findings, organizations can formulate more effective, evidence-based OSH strategies. This academic approach not only enriches theoretical knowledge but also provides more precise policy direction. Therefore, literature reviews serve as an important foundation for formulating sustainable occupational safety policies.

Integrating research findings with industry practices is a strategic step to strengthen comprehensive OHS implementation. Literature reviews serve as a bridge between scientific knowledge and the practical needs of companies in addressing evolving occupational safety challenges. Systematically documented research results can be used as guidelines for data-driven decision-making at the managerial level. This approach reinforces the principle of evidence-based practice, which positions occupational safety as a strategic issue, rather than merely formal compliance with regulations. Thus, designed OHS policies will be more adaptive to changes in the industrial environment and technological developments. Consistent application of study results will accelerate the creation of a strong safety culture in the manufacturing environment. This effort is expected to significantly reduce the number of workplace accidents while improving worker well-being. The overall process demonstrates that the implementation of OHS based on scientific studies is the foundation for achieving the sustainability and competitiveness of the manufacturing industry in the future.

RESEARCH METHODS

The research method used in the study entitled "Implementation of the Occupational Safety and Health (K3) Program in Reducing the Number of Workplace Accidents in the Manufacturing Industry: A Literature Study" uses a qualitative approach with a literature review method. This approach was chosen because the main objective of the study is to examine in depth various previous research results related to the effectiveness of the implementation of the Occupational Safety and Health (K3) program in reducing the number of workplace accidents in the manufacturing sector. Qualitative research is interpretive and oriented towards understanding social phenomena through analyzing the meaning contained in the data, not through numbers or statistics. According to Creswell (2018), qualitative research allows researchers to explore the meaning, patterns, and complex relationships between social variables

through a descriptive-analytical approach. This approach is relevant for interpreting the phenomenon of K3 implementation which is not only technical in nature, but also influenced by cultural, behavioral, and managerial dimensions in the industrial environment.

The literature review process was conducted through systematic stages that included the identification, selection, analysis, and synthesis of various relevant scientific sources. Data sources were obtained from national and international journals, scientific textbooks, research reports, and publications from official institutions such as the ILO, BPJS Ketenagakerjaan, and the Ministry of Manpower. According to Snyder (2019), a systematic literature review serves to gather scientific evidence from various previous studies to formulate more comprehensive and valid conclusions. Source selection was based on inclusion criteria such as the publication period (2015–2025), the topic's relevance to OSH in the manufacturing sector, and measurable methodological quality. This systematic approach ensures that all analyzed data has high credibility and consistently supports the research objectives.

The data analysis phase was conducted using content analysis techniques, which focused on identifying key themes, key concepts, and relationships between variables that frequently appeared in the selected literature. Krippendorff (2018) explains that content analysis is a qualitative method that allows researchers to interpret the meaning of text objectively and systematically to discover conceptual patterns or trends. Through this analysis, various research findings on the implementation of OHS programs were compared to identify similarities and differences in their practices in the manufacturing industry. Each finding was classified into several categories, such as implementation strategies, inhibiting factors, policy effectiveness, and impact on reducing workplace accidents. This process of grouping themes helped researchers formulate a more focused conceptual framework regarding the effectiveness of OHS programs.

The next stage is literature synthesis, which integrates all analysis results into a complete pattern of relationships between cause and effect variables. This approach aligns with Cooper's (2016) view, which states that the primary purpose of a literature review is not simply to summarize previous research but also to identify knowledge gaps and propose directions for further research. Through synthesis, a comprehensive picture is obtained of the extent to which OHS implementation has proven effective in reducing workplace accidents, as well as the contextual factors that influence its success. This process strengthens the scientific argument that OHS effectiveness is determined not only by formal policies but also by safety culture, ongoing training, and top management commitment.

To clarify the research implementation flow, the following table presents the stages of the qualitative literature study method used:

Research Stage	The main purpose	Process Activities	and Output Generated
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Identification of problems	Determining the focus of the study and scope	Examining the issue of work accidents and the urgency of implementing K3	Problem formulation and research limitations
Literature Search	Collecting relevant scientific sources	Browse journals, books, official agency reports (2015–2025)	List of selected literature
Quality Evaluation	Ensuring the credibility of sources	Assess the method, validity, and relevance of each literature	High quality sources
Content Analysis	Identifying major themes and patterns	Coding, categorizing, and interpreting text	Thematic findings and conceptual relationships
Data Synthesis	Draw up conceptual conclusions	Integrating the analysis results into a conceptual model of K3 effectiveness	Theoretical model and policy recommendations

The entire research process was conducted systematically, taking into account the principles of qualitative validity and reliability. Data validity was maintained through source triangulation, which involves comparing study results from various publications to ensure consistency of information. According to Lincoln and Guba (1985), the credibility of qualitative research results can be strengthened through triangulation and critical reflection on the findings. Researchers also evaluated potential biases that might arise from differences in perspectives between authors. In this way, research results are expected to have a high level of reliability and be academically accountable.

A qualitative approach based on literature also allows for interpretive analysis that emphasizes the meaning behind empirical phenomena. Interpretation of research results is directed at explaining how the implementation of OHS in the manufacturing sector contributes to reducing workplace accidents through behavioral changes, increased awareness, and strengthening safety management systems. This perspective aligns with Patton's (2015) view, which asserts that qualitative research is oriented toward a deep understanding of social dynamics that cannot be explained solely through numbers. Therefore, the results of this study provide not only descriptions but also scientific interpretations of the determining factors of OHS success in the manufacturing industry context.

Through this methodology, this research is expected to provide theoretical and practical contributions to the development of occupational safety policies in Indonesia. The findings from the literature review will be used to formulate a conceptual model that illustrates the relationship between the implementation of

occupational safety and health programs and the reduction in workplace accident rates. This model is expected to serve as a reference for manufacturing companies in designing more effective safety strategies, based on empirical evidence and aligned with modern management principles. The systematic and theory-based approach makes this research highly scientifically significant in enriching the occupational safety literature, while also supporting national efforts towards a safe, healthy, and productive work culture.

RESULTS AND DISCUSSION

1. Effectiveness of K3 Program Implementation in Reducing the Number of Work Accidents

The implementation of OSH programs in the manufacturing sector demonstrates a positive correlation between comprehensive safety systems and a reduction in the frequency of workplace accidents. International literature, such as studies by the International Labor Organization (ILO) and various industrial studies in developed countries, has found that companies implementing comprehensive OSH policies, including routine training, the use of personal protective equipment (PPE), periodic inspections, and safety audits, experience a 30% to 50% reduction in accidents within 2–5 years of full implementation. This success is also influenced by the level of worker compliance with safety procedures; structural equation modeling research suggests that safety climate and safety leadership have a direct effect on worker safe behavior, which in turn reduces workplace incidents. OSH effectiveness is measured not only by accident rates but also by intangible assets such as reduced absenteeism due to work injuries, reduced compensation costs, and improved work morale (Ayuni et al., 2022). For example, in a South Korean manufacturing company, a study of laboratory workers found that 83.6% of accidents were caused by human factors such as negligence and failure to use PPE, and safe behavior policy interventions significantly reduced this proportion. The literature review also notes that supporting technologies such as safety sensors and real-time monitoring systems accelerate hazard detection, allowing corrective responses to be implemented before incidents occur. All of this evidence supports that the effectiveness of an OHS program is heavily influenced by structural (policies and systems), technical (PPE application, technology), and behavioral aspects.

One key element is top management commitment, which, according to Hidayah & Zaman (2022) and others, must involve the allocation of resources, time, budget, and expert safety personnel. Without top management support, OHS programs often remain mere formalities, lacking oversight or firm action against violations. Studies in small and medium-sized companies have found that even when safety policies are in place, the lack of funding for safety equipment maintenance and training substantially reduces effectiveness (Widjaja et al., 2025). Another element is ongoing training: the literature shows that occasional training is insufficient; refresher training, emergency simulations, and after-action reviews are needed to ensure workers do not forget procedures or

lose their sensitivity to risks. Furthermore, involving workers in risk assessments and safety policy development, for example through participatory ergonomics or safety committees, has been shown to increase compliance and reduce accidents. These factors are interrelated: good systems and strong policies will fail if worker behavior and organizational culture are not supportive.

OHS effectiveness measurement indicators include the number of accidents. These indicators include: Lost Time Injury Frequency Rate (LTIFR), severity rate (accident severity), compliance with PPE use, number of near-miss incident reports, and safety audit scores (Mahameru, 2023). For example, a study in Southeast Asian manufacturing using LTIFR as a metric noted that after implementing an audit and training program, the LTIFR decreased from 8.5 to 4.2 within two years. Empirical data such as this demonstrates that OHS programs not only reduce the number of incidents but also improve safety more holistically. The literature also suggests that companies that use a proactive approach (hazard identification, risk assessment) often achieve greater reductions in severity rates than those that are solely reactive (waiting for an accident to occur before investigating). Therefore, the effectiveness of an OHS program can be considered dependent on the use of these key indicators as part of the evaluation system.

The following table is a synthetic illustration from various literature on changes in several main occupational safety indicators after the implementation of K3:

Indicator	Before Implementation	After Implementation (1-3 years)	Decrease / Change (%)
LTIFR (Lost Time Injury Frequency Rate)	~8.5 per million man-hours	~4.2 per million hours worked	± 50%
Severity Rate (accident severity level)	Severe incidents >10% of total	Decreased to ≈5-6%	~40-50%
Compliance with the use of PPE	~60-70%	~90-95%	+25-35 percentage points
Near-miss reporting	low, < one per month	increased to several per month	>100% increase in reports

The final paragraph concludes that the effectiveness of an OHS program in reducing workplace accident rates in the manufacturing industry depends heavily on the integration of formal safety systems, resource management, the involvement of all parties within the organization, and the monitoring of safety performance indicators. The literature concludes that without any of these elements, effectiveness will be limited even with theoretical regulations and

policies in place. Therefore, manufacturing companies need to design a comprehensive OHS program, with a clear audit and monitoring system, management commitment, ongoing training, and a strong safety culture to achieve a significant reduction in workplace accidents.

2. Factors Inhibiting the Implementation of the K3 Program in the Manufacturing Sector

Obstacles to the implementation of Occupational Safety and Health (OHS) programs in the manufacturing sector are often systemic, encompassing intertwined regulatory, structural, and technical aspects. Existing regulations are often general and not fully adaptable to the diverse characteristics of the manufacturing industry, resulting in inconsistent interpretation and application across companies. Inconsistent oversight by relevant authorities weakens the implementation of safety standards, as many violations go undetected routinely. This situation is exacerbated by the limited capacity of supervisory agencies, both in terms of personnel and the technical competency required to objectively assess company compliance. As a result, policies that formally appear comprehensive are not always effectively translated into practical practice on the ground, particularly in small and medium-sized companies facing financial and resource constraints.

Another obstacle arises from organizational culture and workforce behavior, which do not fully support the implementation of occupational safety. Many workers view OHS procedures as an additional burden that hinders productivity, rather than as a means of self-protection. This mindset arises from a lack of training that builds intrinsic awareness of occupational risks, as well as weak two-way communication between management and employees regarding the urgency of safety. Research by Sileyew (2020) shows that the majority of workplace accidents in the manufacturing industry are caused by human error, reflecting the low internalization of safety values in daily work behavior. The absence of a reward system for safe behavior also leads to workers being less motivated to comply with OHS procedures. Without the support of a strong organizational culture, the implementation of safety policies tends to stop at the administrative level without resulting in substantive behavioral change.

The resource aspect is an equally important inhibiting factor, especially for companies with limited economic capacity. Implementing an OHS program requires a relatively large initial investment, both for the procurement of personal protective equipment, safety training, and the establishment of a dedicated risk monitoring unit (Hidayah & Zaman, 2022; Yumna & Ramadhani, 2025). Many small companies in the manufacturing sector prioritize occupational safety over production targets, often reducing the allocation of funds for safety aspects. Case studies in Southeast Asia indicate that limited funding prevents 45% of small companies from conducting regular safety audits, while another 30% lack certified OHS experts. This situation demonstrates that economic constraints are not merely financial barriers but also impact weak oversight systems and technical capacity building at the operational level.

The gap between national policies and implementation on the ground further highlights the complexity of the challenges of OHS implementation (Malik & Pinto, 2025). Many companies operating in labor-intensive industrial areas still face technical obstacles in adapting national regulations to local situations, such as limited infrastructure and low safety literacy among workers. The lack of synchronization between central government policies and those implemented at the regional level leads to significant variations in safety standards across regions. Other external factors such as global market pressures, competitive production costs, and the need for time efficiency often force management to sacrifice safety aspects to maintain competitiveness (Selvia et al., 2025). This phenomenon demonstrates that OHS implementation cannot stand alone but relies on regulatory stability, economic support, and cross-sector policy alignment.

All of these obstacles illustrate that the success of an OHS program is determined not only by the availability of regulations, but also by the extent to which those regulations can be effectively implemented through collaboration between management, workers, and the government. Strengthening the capacity of supervisory institutions, increasing safety budgets, and providing ongoing safety education are crucial steps to overcome existing obstacles. Without systematic efforts to address the root causes of these obstacles, effective OHS implementation will be difficult to achieve even if policy instruments are continuously refined. Therefore, synergy between structural, behavioral, and economic aspects is necessary so that OHS programs in the manufacturing sector are not merely normative but truly become optimally functioning and sustainable occupational protection mechanisms.

3. Strategy for Strengthening Occupational Safety Culture as an Effort to Sustain the Implementation of K3

Strengthening a work safety culture is a fundamental element in ensuring the sustainable implementation of OHS programs in the manufacturing industry. A safety culture encompasses not only adherence to formal procedures but also reflects collective values, beliefs, and attitudes that prioritize safety in all work activities. Organizations that successfully build a strong safety culture demonstrate lower workplace accident rates and increased productivity due to reduced lost time due to injuries. According to Oktaria (2025), a safety culture is formed through the dynamic interaction between management systems, individual behavior, and the social environment in the workplace. This process requires the active involvement of all levels of the organization, from top management to production line workers, so that safety values can be consistently internalized.

Safety-oriented leadership is a key driver of a safe work culture. Leaders who demonstrate a clear commitment to safety through role models, open communication, and risk-based decision-making foster trust and a sense of collective responsibility among employees. Research by Fatchurrohman et al. (2025) confirms that a transformational leadership style is positively correlated

with compliance with safety regulations and a reduction in accidents. When management demonstrates concern for employee well-being, employees are more motivated to maintain their own safety and that of their colleagues. A work environment that values transparency and learning from mistakes also strengthens an organization's ability to prevent recurrence of similar incidents (Wahyudi et al., 2025).

Employee participation is a crucial pillar in strengthening a sustainable safety culture. Active employee involvement in planning, hazard identification, and risk evaluation creates a sense of ownership in the safety system. According to Cahyani & Ars (2025), meaningful participation increases workers' intrinsic motivation to behave safely because they feel part of the decision-making process. Implementing a non-punitive incident reporting system has also been shown to increase transparency and accelerate early detection of potential hazards. When employees have the space to voice their opinions and experiences, organizations can gain rich empirical data to continuously improve their safety systems.

The use of modern technology also strengthens the strategy of building a safety culture through more adaptive information and monitoring systems. Implementing technologies such as real-time safety monitoring, hazard detection sensors, and data analytics-based digital applications enables companies to identify risk patterns and anticipate accidents before they occur. A 2023 report from the International Labour Organization (ILO) shows that the use of digital technology in OHS management can reduce the potential for accidents by up to 35% in high-risk industries. Technology integration also accelerates the training process and evaluation of safety behaviors through virtual reality-based simulations that increase risk awareness among workers. Thus, digital transformation is not only an efficiency tool but also a means to strengthen safety values across every production line.

The synergy between leadership, employee participation, and technological innovation creates an organizational ecosystem that is resilient to safety risks. A strong safety culture does not develop overnight, but rather through a continuous, collective learning process supported by a reward system for safe behavior. When safety values are internalized within the organization's identity, all production activities will be oriented toward protecting people as the company's primary asset. Strengthening a safety culture is a true indicator of the maturity of an OHS system, where success is measured not only by a decrease in accidents but also by increased awareness, moral responsibility, and psychological well-being of workers. With this approach, the manufacturing industry is able to create a safe, productive, and socially and economically sustainable work environment.

CONCLUSION

A literature review of the implementation of Occupational Safety and Health (OHS) programs in the manufacturing industry indicates that the effectiveness of safety systems is highly dependent on the integration of

policies, behavior, and organizational culture. A comprehensively planned and implemented OHS program has been shown to significantly reduce workplace accidents through the implementation of safety procedures, ongoing training, and systematic monitoring of workplace risks. Top management commitment is a key determinant of success, as it determines the extent to which resources are allocated to strengthening safety systems and employee engagement. Program effectiveness is also influenced by the level of employee compliance with safety regulations, which can be enhanced through the development of an organizational culture based on participation and trust. Implementation barriers remain, including limited funding, inadequate supervision, low employee motivation, and mismatches between policies and field practices. These structural and behavioral factors contribute to variations in effectiveness between companies, particularly in the medium- to small-scale manufacturing sector, which has limited resources. Therefore, strengthening a safety culture is a fundamental strategy to ensure the sustainability of OHS implementation, not merely as an administrative obligation but as a core organizational value. Safety-oriented leadership, adaptive training systems, and the use of digital technologies such as real-time monitoring have been shown to strengthen organizational responses to potential hazards. Active worker participation and the implementation of a reward system for safe behavior accelerate the internalization of safety values in the workplace. Integrating safety policies with technological innovation and national regulatory support strengthens the effectiveness of OSH implementation at the macro level. Thus, OSH success is measured not only by reducing accident rates but also by increasing worker awareness, discipline, and well-being. This study confirms that developing a strong safety culture is a key prerequisite for creating a productive, competitive, and socially and economically sustainable manufacturing industry

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