RESEARCH PAPER

Implementation of the ISO 45001 Standard to Reduce Occupational Incidents in Workers of a Real Estate Consortium, Lima 2025

Henry Santos Haro Rosales[1], Ángela Dona Grados Enríquez[2] and Ronald Fernando Dávila Laguna[3]

[1,2.3]*Universidad César Vallejo, Perú*
[1]*Email: kenny.reyyes1818@gmail.com,* [2]*Email: donagrados@gmail.com and* [3]*Email: rdavilala@ucvvirtual.edu.pe*
[1]*ORCID: https://orcid.org/0009-0005-9241-5450,* [2]*ORCID: https://orcid.org/0009-0008-3953-4575 and* [3]*ORCID: https://orcid.org/0000-0001-9886-0452*

ABSTRACT
The research presented, consistent with Sustainable Development Goal No. 8, sought to evaluate the impact of the adoption of the ISO 45001:2018 standard on the reduction of occupational accidents within a real estate consortium in Lima. A methodological approach was employed, incorporating a quantitative design at an explanatory level and a pre-experimental format. The population of interest comprised the records of incidents that occurred during a 12-week period, encompassing the intervention and the subsequent 12 weeks. The data were collected through two methods: direct observation and document analysis, employing accident record forms. The findings indicated a substantial decrease in the aggregate number of work incidents, with a decline below 68. The percentage decreased from 25% in the period prior to the intervention to 28.75% in the aftermath, which is equivalent to a decrease of 57.88%. Conversely, the number of incidents with consequences was reduced from 52. The proportion of subjects who exhibited consequences decreased from 75% to 31.92% (a decrease of 39.49%), while those who did not exhibit consequences fell below 60%. 33% to 35. A 41.29% decrease has been observed, resulting in a 42% reduction. The findings of this study lend support to the hypothesis that the implementation of the ISO 45001 standard has a substantial positive impact on performance in the domain of occupational health and safety. The standard appears to serve to reinforce a preventive culture and to reduce exposure to risk. It has been determined that the systematic implementation of this standard is an effective strategy for reducing occupational accidents in the specified environment.
Keywords: *ISO 45001, Safety Management, Occupational Health, Occupational Incidents, Prevention.*
How to cite this article: Haro Rosales HS, Grados Enríquez AD and Dávila Laguna RF, Implementation of the ISO 45001 Standard to Reduce Occupational Incidents in Workers of a Real Estate Consortium, Lima 2025. Int J Drug Deliv Technol. 2026;16(10s): 881-893; DOI: 10.25258/ijddt.16.10s.103
Source of support: Nil.
Conflict of interest: None

1. INTRODUCTION

In the contemporary business landscape, occupational health and safety have emerged as pivotal components of corporate management, particularly in high-risk sectors such as construction. In accordance with Sustainable Development Goal No. 8, which aims to promote safe, dignified, and sustainable employment opportunities, this study underscores the significance of enhancing work environments through the implementation of well-structured management systems. This objective is consistent with the principles outlined in ISO 45001:2018, which emphasizes the proactive management of occupational risks through the identification of potential hazards, comprehensive hazard assessments, and the implementation of effective control measures. In essence, these initiatives offer a multifaceted approach to enhancing organizational efficiency, with a focus on the following key areas:

The significance of the subject is evident when examining the historical and global context of occupational safety. Since time immemorial, prominent civilizations have emerged in precarious work environments, characterized by the absence of adequate safety measures for individuals engaged in economic activities. The advent of the twentieth century, particularly following the First World War, marked the inception of the initial international endeavors to ensure the safety of workers. This development culminated in the establishment of the International Labour Organization (ILO) in 1919. Nevertheless, despite the technological, regulatory, and scientific advances that have transpired over the past century, occupational hazards persist as a global problem. According to the ILO (2023), approximately three million deaths per year are attributable to work-related accidents and diseases, in addition to approximately 375 million non-fatal injuries. These statistics reveal not only the persistence of unsafe conditions and inadequate practices, but also the discrepancy between the regulations and their actual application in countries, especially in those with limitations in training, monitoring, and incident reporting.

In Latin America, the situation is exacerbated by the high rate of labor informality, which in some countries exceeds

**Author for Correspondence: kenny.reyyes1818@gmail.com*

50%, complicating the implementation of formal occupational safety and health management systems (ECLAC, 2023). The ILO (2019) has noted that in this region, the incidence of accidents per 100 workers per year is approximately 11, although it cautions that this figure may be an underestimation due to the absence of comprehensive records. In Peru, the construction sector plays a pivotal role in the national economy, contributing significantly to GDP and employment opportunities. However, it is also susceptible to the risks inherent in its diverse range of activities (Lima Chamber of Commerce, 2024). In the initial months of 2024, a total exceeding 5,000 workplace incidents were documented across various sectors, with construction being the most prevalent and severe. The Federation of Civil Construction Workers of Peru (FTCCP) has estimated that approximately five workers per month lose their lives and eight suffer daily accidents in formal works. If the informal sector is also considered, these numbers increase (RCR Peru, 2024).

Despite the existence of technical standards and regulations in Peru designed to manage construction risks, compliance with these measures is uneven, thereby creating an environment conducive to workplace accidents. The Ministry of Housing, Construction and Sanitation (2021) has noted that in projects involving multi-family housing, there is a recurring pattern of noncompliance with mandatory regulations, a situation that poses significant risks to both workers and the environment. The existence of laws, in and of itself, does not guarantee a safe environment. Consequently, organizations are obliged to implement structured management systems, ensure standardized processes, and promote continuous staff participation. The implementation of standards such as ISO 45001 has been identified as a key facilitator of this process, by offering a technical framework that can be adapted to any type of entity. This framework integrates aspects such as leadership, operations, document control, and continuous improvement.

In the real estate consortium under study, a multifaceted set of factors was identified as contributing to the high rate of incidents, including: inadequate supervision, absence of formal procedures, challenges in document management, limited participation of senior management, and a lack of awareness among workers regarding the particular risks associated with their roles. A comprehensive investigation was conducted to identify the underlying causes of unsafe actions, hazardous conditions, human errors, inadequate training, and deficiencies in procedural design. This investigation used various analytical tools, including brainstorming, the 6M analysis, Ishikawa diagrams, Vester matrices, and Pareto analysis. Through these meticulous methods, the investigation yielded significant insights, highlighting the presence of fundamental issues that contribute to the occurrence of these phenomena. These analyses facilitated comprehension of the intricacies inherent in the problem, thereby enabling the establishment of intervention priorities that are congruent with the tenets delineated in chapters 6 and 10 of ISO 45001, which emphasize the principles of planning and continuous improvement.

In this sense, the research is based on the following main question: The objective of this study is to examine the impact of the implementation of the ISO 45001 Standard on the reduction of occupational accidents among the employees of a real estate consortium in Lima by the year 2025. Consequently, two specific inquiries emerge from this inquiry, focusing on the mitigation of incidents, both with and without consequences. The rationale of the study is based on three key axes: The study is theoretical in nature, as it offers insights into the efficacy of preventive management in high-risk contexts. It facilitates a comparison between ISO 45001 and academic and regulatory standards. Methodologically, the study employs a quantitative approach with a pre-experimental design, enabling a comparison of the pre- and post-intervention scenarios through the utilization of validated tools and real data. Practically, it presents a replicable proposal that fosters a culture of prevention, enhances internal procedures, reduces incidents, and promotes the physical and mental well-being of employees, as indicated by Atúncar-Prieto (2025).

The present study is consistent with the findings of previous research conducted both nationally and internationally, which lends support to the relevance of the present study's findings. A substantial body of research has emerged in recent years, with studies by Daoudi and Mendli (2025), Betancur (2021), Martínez et al. (2021), Acosta et al. (2024), Criollo et al. (2024), Morales (2024), Benites et al. (2023), Cusiche et al. (2023), Aybar et al. (2023), Mota et al. (2023), and Almanza et al. (2022) indicating a notable decrease in risks, occurrences, and incidents following the adoption of ISO 45001 or equivalent systems. This finding suggests that ISO 45001 is an effective safety management standard for various work environments. It is also posited that the standard should not be regarded exclusively as a formal obligation; rather, it should be conceptualized as a strategic instrument that fosters enhanced competitiveness, productivity, and sustainability within organizational frameworks.

Consequently, this study is predicated on the pressing and authentic necessity to devise preventive mechanisms that guarantee the integrity of the workers in the aforementioned real estate consortium. The implementation of the ISO 45001 Standard represents a significant opportunity to formalize safe processes, standardize work methods, strengthen leadership in prevention, and promote a cultural change that, in a sustainable manner, reduces the occurrence of occupational accidents in the workplace.

2. THEORETICAL FRAMEWORK

The Occupational Health and Safety Management System (OH&S-MS) is a prevention-oriented method that combines policies, processes, procedures, audits, and corrective actions to safeguard the physical, mental, and social health of employees. This objective is realized through the identification, evaluation, and control of the

risks associated with work, following a structured model in the PHVA cycle. This cycle facilitates the anticipation of occupational incidents and diseases through planning, implementation, verification, and continuous improvement (Ministry of Labor of Colombia, 2022; Álvarez, 2022). In this context, ISO 45001:2018 is regarded as the inaugural international standard that establishes the requisite conditions for implementing an occupational health and safety management system, with the objective of preventing injuries and diseases in the workplace. This standard integrates leadership, worker participation, risk management, operational control, and continuous improvement through a scheme based on Annex SL. This ensures its compatibility with standards such as ISO 9001 and ISO 14001. The standard employs a strategic approach to the PHVA cycle to ensure systematic and dynamic risk management (ISO, 2018). The standard incorporates requirements related to the organizational context, leadership, planning, support, operation, performance evaluation, and continuous improvement. These requirements allow for the establishment of adequate controls, management of operational changes, audits, and feedback on the system based on the deviations found. In the context of occupational safety and health, workplace incidents are defined as any unintended occurrence in the workplace that has the potential to result in physical harm, injury, damage, or the onset of a disease. These incidents can be classified into two distinct categories: those with consequences, which manifest when incidents result in physical harm, and those without consequences, which occur when incidents, although not causing harm, pose a substantial risk. The occurrence of these events has been linked to various factors, including unsafe acts, dangerous conditions, lack of supervision, human error, procedural deficiencies, failures in task design, operational pressure, and weaknesses in the preventive culture (ILO, 2020; OSHAS, 2018). Classical theories, including that of Heinrich (1931), have indicated that 88% of incidents are attributable to unsafe acts, while 12% are attributed to dangerous conditions. Conversely, Reason (1997) posits, through his "Swiss cheese" model, that incidents arise from the convergence of active and latent failures within the organizational structure. This perspective underscores the imperative for the fortification of preventive barriers. From a systems perspective, organizations function as interdependent structures in which people, processes, technology, and environment constantly interact, so enhancement in one component leads to the optimization of the system as a whole (Chambie, 2021). In this sense, the implementation of ISO 45001 directly contributes to the reduction of incidents. This is achieved through the standardization of processes, the strengthening of preventive leadership, the active participation of employees, systematic training, the management of operational changes, the creation of safe procedures, the identification of hazards, and the evaluation of risks. Additionally, operational control and the performance of audits and corrective actions that promote a solid organizational culture focused on prevention are essential. A multitude of national and international studies have demonstrated that the implementation of ISO 45001 leads to a reduction in incident and accident rates by 30% to 90%. These studies, including those by Daoudi and Mendli (2025), Betancur (2021), Martínez et al. (2021), Acosta et al. (2024), Criollo et al. (2024), Morales (2024), Benites et al. (2023), Cusiche and Taipe (2023), Aybar et al. (2023), Mota et al. (2023), and Almanza et al. (2022), offer compelling evidence that ISO 45001 enhances the culture of prevention, strengthens regulatory compliance, and optimizes operational performance. This evidence confirms the effectiveness of ISO 45001 in high-risk sectors, such as construction. Therefore, the correlation between the implementation of ISO 45001 and the mitigation of occupational hazards is predicated on its capacity to integrate control mechanisms, delineate responsibilities, establish secure procedures, enhance internal communication, and consolidate monitoring and continuous improvement mechanisms. This integration enables the identification of incident causative factors and the subsequent mitigation of risk exposure in workplaces.

3. OBJECTIVE

To determine how the implementation of the ISO 45001 Standard reduces occupational incidents in workers of a real estate consortium, Lima 2025.

4. METHODOLOGY

The research presented is of an applied nature, as it centered on the practical application of scientific knowledge to address a tangible issue concerning safety and health in the workplace within a real estate consortium. According to Thomas (2021), the objective of this research is to devise specific solutions for particular situations by employing suitable theoretical and methodological frameworks. In this instance, the ISO 45001:2018 Standard was implemented in the organization's construction procedures.

The analysis employed a quantitative approach, as it sought to objectively verify the connection between the application of the standard and the decrease in occupational incidents. This was achieved by using measurable data from formal records and direct observations. This approach involves the collection of numerical data and its subsequent statistical analysis to evaluate the variability and behavior of the variables involved, as explained by Walliman (2021). The explanatory level facilitated the identification of the causes and effects associated with the occurrence of incidents, as well as the comprehension of the impact of the implementation of ISO 45001 controls on occupational safety performance indicators, according to Arias (2012) and Terrell (2022).

The methodological design was pre-experimental, which is characterized by the evaluation of a single group before and after the intervention, without random assignment or comparison group. According to Hernández et al. (2014), this type of design is suitable for exploratory studies in real environments that seek to assess the effect of an action or program. In this case, the research included an initial diagnosis (pretest), the implementation of the ISO 45001

guidelines, and a final measurement (post-test) that made it possible to compare the impact of the management system on the reduction of incidents. The design was delineated through the DI – I – IN – NX stages, corresponding to the company's diagnosis, initial measurement, implementation, and subsequent measurement, respectively.

In regard to the variables, the independent variable was the implementation of the ISO 45001:2018 Standard, which was operationalized in its four fundamental dimensions: organizational context, leadership and support, planning and operation, and continuous improvement. These dimensions encompass activities such as risk identification, hazard assessment, the delineation of the OH&S MS, the allocation of responsibilities, staff training, the documentation of the system, and the implementation of operational controls. Conversely, the dependent variable, the work-related incident, was defined as any work-related event that can cause or has caused harm. This variable was operationalized in two dimensions: incidents with consequences and incidents without consequences, according to the definitions of the ILO (2001) and OSHAS (2018).

The sample comprised weekly reports of labor incidents that occurred during 12 weeks prior to and following the intervention, in the masonry, carpentry, and structures sectors, encompassing a total of 10 workers. Upon incorporating all available reports into the analysis, it was observed that the sample reflected the total population, excluding the application of sampling techniques. The inclusion criteria were defined as all incidents that occurred during the working day from Monday to Saturday in the aforementioned sectors, while the exclusion criteria were considered those incidents that occurred outside working hours or outside the consortium's workspaces.

Two methods were employed for the collection of information: direct observation and document analysis. The primary objective of the first method was to facilitate the identification of dangerous conditions, unsafe acts, and behaviors related to the occurrence of incidents. These objectives were achieved in accordance with the events that were recorded on site. The second method permitted the examination of accident reports, operational records, incident reports, and other documents pertinent to safety management. The structured observation sheet and the record sheet of work incidents were used, and they were adapted according to the requirements of the ISO 45001 Standard. The validation of these documents was conducted by three experts in Industrial Engineering from the César Vallejo University, as indicated in the list of specialists.

The instruments' validity was confirmed through expert evaluation, which ensured the relevance, clarity, and adequacy of the items according to the study's dimensions. The reliability of the records was established through the signature and validation by the management and the resident engineer of the work. The validity of the records used was confirmed by the parties. Moreover, formal authorization was obtained from the company to access the documents and register the required information.

The data were then subjected to a thorough analysis, employing a combination of descriptive and inferential statistical techniques. For the descriptive analysis, measures of central tendency, frequencies, and percentages were employed, thus enabling the examination of variation in incidents before and after the intervention. For the inferential analysis, the Shapiro-Wilk normality test was applied to establish the distribution of the data. Subsequently, the Student's T-test was used for related samples to verify the existence of significant differences between the pre- and post-intervention measurements. This was done in accordance with the decision criteria proposed by Hernández (2021).

Finally, the ethical aspects were ensured, in compliance with the regulations of the César Vallejo University, including the principles of truthfulness, autonomy, beneficence, and intentionality. The information was handled with confidentiality, authentic records authorized by the company were used, and the guidelines of the institutional Code of Ethics were followed. Pursuant to Resolution No. 0470-2022/UCV, an originality review was conducted using Turnitin to ensure the academic integrity of the study.

5. RESULTS

Descriptive analysis

The descriptive analysis is presented, with respect to the independent variable, corresponding to the implementation of the ISO 45001 Standard, comparing the pre-test and post-test values. These results show the progress made in each dimension of the occupational health and safety management system within the Real Estate Consortium.

Dimension 1: Context of the organization

This dimension analyzes the consortium's ability to identify the internal and external elements that impact its performance in occupational health and safety, as well as to recognize the needs of its stakeholders.

In the initial evaluation (pre-test) a compliance of 52% was obtained, while after applying the ISO 45001 standard (post-test) the level reached 84%.

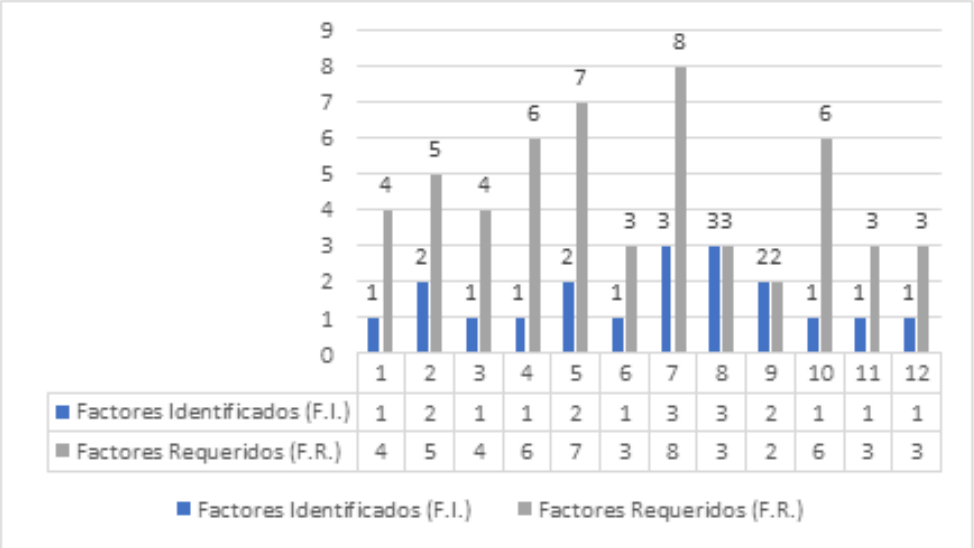

Figure 1. Comparison of the dimension "Context of the organization", Pre-test and Post-test.

Source: Own elaboration

The 32% increase reflects an important advance in the strategic management of the organizational context, demonstrating that the consortium managed to integrate health and safety into its internal processes and strengthen its analysis of risks and opportunities.

Dimension 2: Leadership and support

This dimension assesses the commitment of senior management and the active collaboration of workers in the development of the management system.

Before implementation (pre-test) compliance was obtained at 58%, and after applying the standard (post-test) 87% was reached.

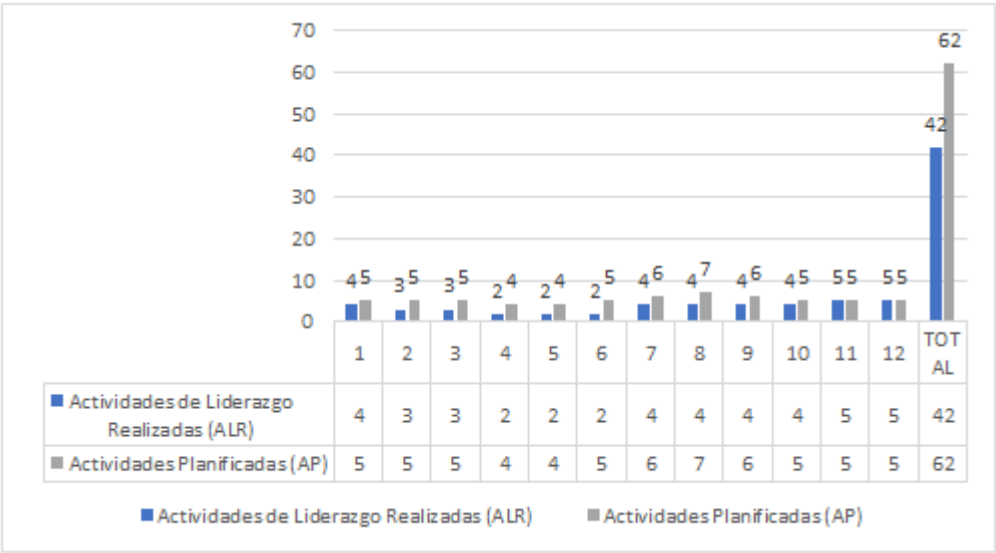

Figure 2. Comparison of leadership and support, Pre-test and Post-test.

Source: Own elaboration

The 29% increase shows greater management involvement and more fluid communication with staff, which has strengthened the preventive culture and collaborative work within the organization.

Dimension 3: Planning and operation

This dimension measures how effectively the company identifies hazards, assesses risks, and establishes appropriate controls in its work activities.

The level of compliance went from 49% in the pre-test to 85% in the post-test.

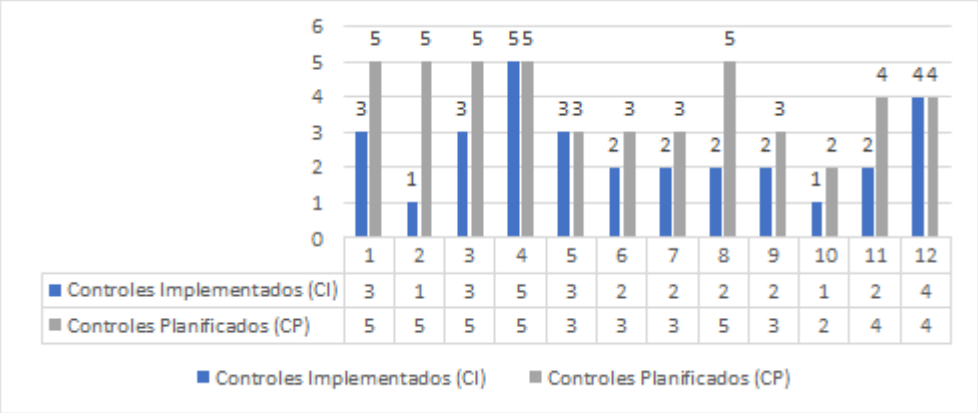

Figure 3. Comparison of the dimension "Planning and operation", Pre-test and Post-test.

Source: Own elaboration

The 36 percentage point increase demonstrates that the consortium effectively applied tools such as IPERC and safe work procedures, significantly reducing the likelihood of incidents and optimizing on-site risk control.

Dimension 4: Continuous improvement

This dimension measures the ability of the consortium to apply corrective and improvement actions based on the observations and results of audits. Compliance went from 61% in the pre-test to 92% in the post-test.

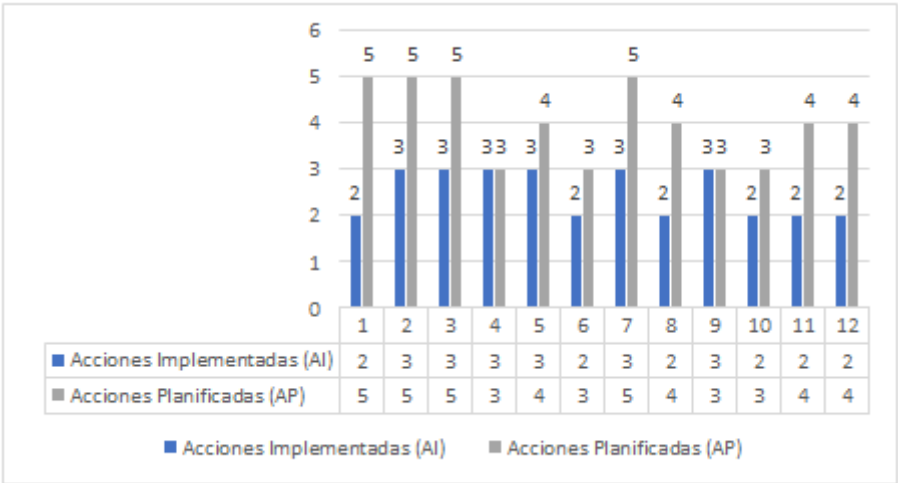

Figure 4. Comparison of continuous improvement, Pre-test and Post-test.

Source: Own elaboration

The 31% increase shows that the company strengthened its system with a preventive approach, implementing constant improvements that ensure the sustainability of the OH&S Management System and progressively reduce occupational risks.

Dependent Variable: Work incidents

In the dependent variable, the behavior of labor incidents before and after the application of the standard was analyzed, considering both incidents with consequence and those without consequence.

Dimension: Incidents with Consequence

In the pre-test, 14 incidents were recorded, while in the post-test they were reduced to 5.

*Author for Correspondence: kenny.reyyes1818@gmail.com

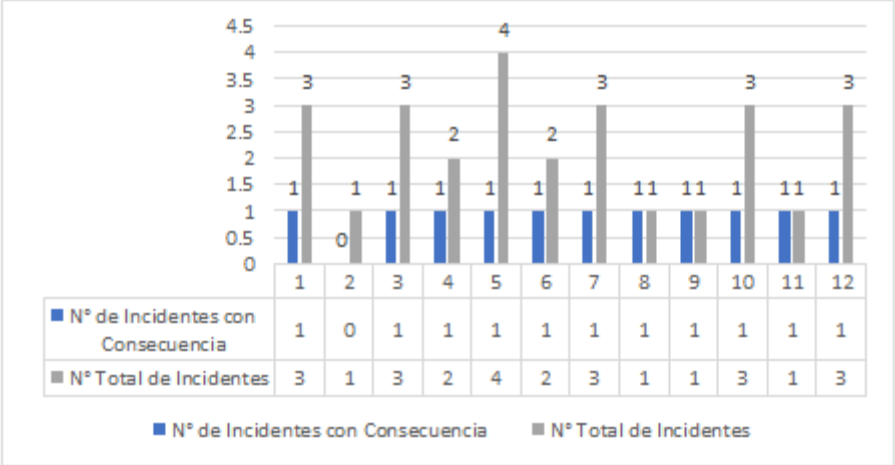

Figure 5. Comparison of incidents with consequence, Pre-test and Post-test.

Source: Own elaboration

This 64% reduction demonstrates the effectiveness of the standard in preventing accidents, thanks to the training of personnel, the proper use of equipment for protection and the strengthening of operational controls.

Dimension: Incidents without consequence

In the case of inconsequential incidents, the records went from 26 in the pre-test to 11 in the post-test.

Figure 6. Comparison of incidents without consequence, Pre-test and Post-test.

Source: Own elaboration

The 57% decrease indicates an improvement in the early detection of unsafe conditions and in the response to potential risks, reflecting a more conscious and proactive safety culture within the consortium.

The findings indicate that the implementation of the ISO 45001:2018 Standard within the Real Estate Consortium, Lima 2025, has yielded substantial enhancements across all facets of the occupational health and safety management system. The organization strengthened its leadership, planning, operational control, and support for continuous improvement. This resulted in a sustained reduction in workplace incidents and greater efficiency and well-being for workers.

Inferential Analysis

Analysis of the General Hypothesis

In order to test the general hypothesis, it is necessary to verify the parametric behavior of the data obtained on occupational incidents, both before and after the implementation of ISO 45001, given that the number of records obtained in occupational accidents and, in general, the number of cases does not exceed 30. Therefore, the Shapiro-Wilk normality test will be used.

Hypothesis statement

H0: It has a non-normal distribution.

Ha: It has a normal distribution.

Table 1. Normality test of data from work incidents with Pre Test – Post Test consequences

Shapiro – Wilk			
Normality test	Statistical	Gl	Significance
Workplace Incidents – Before	0.934	12	0.268
Workplace Incidents – After	0.972	12	0.841

Source: Own elaboration

Table 1 shows the significance for occupational incidents before improvement was 0.268 and after 0.841.

As both values are greater than 0.05, according to the decision rule shown, the data is considered to have a parametric behavior.

Therefore, Student's t-test is used to analyze the verification of the general hypothesis.

General Hypothesis Testing: Workplace Incidents

H0: The implementation of ISO 45001 does not reduce work incidents in workers of a real estate company in Lima during the year 2025.

Ha: The implementation of the ISO 45001 standard reduces labor incidents in workers of a real estate company in Lima during the year 2025.

In order to accurately contrast, the analysis was carried out using the p value or significance obtained with the Student's T-test applied to the records of occupational incidents before and after the implementation of the ISO 45001 Standard.

Table 2. Comparison of matched samples of before-and-after work-related incidents with Student's T statistic

Matched Sample Statistics				
	Average (%)	N	Desv. standard	Standard Mean Error
Workplace Incidents – Before	68.25%	12	1.12000	0.32338
Workplace Incidents – After	28.75%	12	1.09500	0.31615

Source: Own elaboration

In table 2, it can be contrasted that the average number of occupational incidents before the implementation of the ISO 45001 Standard was 68.25%, while after implementation it was reduced to 28.75%.

Therefore, the null hypothesis is not fulfilled, the null hypothesis that establishes that the implementation of ISO 45001 does not reduce labor incidents is rejected, and the alternative hypothesis is accepted, which demonstrates that the implementation of ISO 45001 significantly reduces labor incidents in the workers of the Real Estate Consortium, Lima 2025.

To validate that the contrast is true, the analysis was carried out using the p-value, evaluating the significance of the results obtained with the Student's T-test applied to the records of occupational incidents before and after the implementation of the ISO 45001 Standard.

Table 3. Student's T Parametric Test Statistics for Work Incidents

	Stocking	**Desv. And.**	**Average Est. Error**	**95% confidence interval**		**t**	**Gl**	**Sig. (bilateral)**
				Inferior	Superior			
Workplace Incidents Before and After	-39.500	1.67892	0.48466	-40.56674	-38.43326	-81.50	11	0.000

Source: Own elaboration

In the Student's t-test, it was evidenced that the data have a significance of 0.000, which, because it follows < 0.05, according to the decision rule, the alternative hypothesis is accepted and the null hypothesis is rejected. This indicates that the implementation of the ISO 45001 Standard significantly reduced labor incidents in the workers of the Real Estate Consortium, Lima 2025.

Reliability - incidents with consequence

Normality Test for Incidents with Consequence

To test the first specific hypothesis, it is essential to establish whether the data obtained from the incidents with consequence, before and after the implementation of the ISO 45001 Standard, present a parametric behavior.

This is relevant, given the data obtained does not exceed 30 cases. Therefore, the normality analysis was compared using the Shapiro-Wilk statistic.

Hypothesis Statement

H0: The implementation of the ISO 45001 standard does not reduce labor incidents with consequences for workers of a real estate company in Lima during the year 2025. They have a normal distribution.

Ha: the implementation of the ISO 45001 standard reduces labor incidents with consequences for workers of a real estate company in Lima during the year 2025. They have a normal distribution.

Table 4. Normality test data on incidents with Pre Test – Post Test **consequence Source:** Own elaboration

Normality test			
	Statistical	Gl	Significance
Incidents with Consequence – Before	0.918	12	0.237
Incidents with Consequence – After	0.965	12	0.676

Table 4 shows that the significance for incidents with consequences before implementation was 0.237 and after 0.676.

As both values are greater than 0.05, it is indicated that the values are of parametric behavior.

Therefore, the Student's t-test is used to analyze the hypothesis.

Specific Hypothesis Testing: Incidents with Consequence

H0: The implementation of the ISO 45001 standard does not reduce labor incidents with consequences for workers of a real estate company in Lima during the year 2025.

Ha: the implementation of the ISO 45001 standard reduces labor incidents with consequences for workers of a real estate company in Lima during the year 2025.

In order to accurately contrast, the value or significance obtained with the Student's T-test was carried out applied to the records of incidents with consequences before and after implementation.

Table 5. Comparison of matched samples of incidents with before-and-after consequences with the Student T statistic

Matched Sample Statistics				
	Average (%)	N	Desv. Deviation	Desv. Average error
Incidents with Consequence – Before	52.75%	12	7.48521	2.16072
Incidents with Consequence – After	31.92%	12	4.21563	1.21681

Source: Own elaboration

In Table 5, it can be seen that the mean of incidents with consequences before implementation was 52.75%, and after 31.92%. Hypothesis H0 is not fulfilled, so the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that the implementation of the ISO 45001 Standard significantly reduced the incidents with consequences in the workers of the Real Estate Consortium, Lima 2025.

Table 6: Student T Parametric Test Statistics for Consequences Incidents

Paired Sample Testing								
Paired differences								
	Stocking	Desv. Deviation	Desv. Average error	95% confidence interval of difference (Lower – Upper)		t	Gl	Sig. (bilateral)
Incidents with consequences before and after	-20.83000	7.85462	2.26891	-26.01830	-15.64170	-9.181	11	0.000

Source: Own elaboration

The analysis carried out using the Student's T statistical test yielded a significance level of 0.000, a value below the critical limit of 0.05. According to the statistical decision criteria, this result allows us to accept the alternative hypothesis and reject the null hypothesis. This statistical evidence confirms that the implementation of the ISO 45001 Standard had a positive and relevant effect on the occupational health and safety of the Real Estate Consortium in Lima (2025). In practical terms, the application of the management system made it possible to significantly reduce the occurrence of incidents with consequences, demonstrating that the adoption of the

*Author for Correspondence: kenny.reyyes1818@gmail.com

standard contributes to strengthening the preventive culture, improving working conditions and increasing efficiency in risk management within the organization.

Responsiveness - Incidents without consequence

Normality Test for Incidents Without Consequence

To validate the second specific hypothesis, it was necessary to analyze whether the data corresponding to the inconsequential incidents, recorded before and after the implementation of the ISO 45001 Standard, followed a parametric distribution. Since the total number of observations was less than 30, the Shapiro-Wilk statistical test was applied, considered the most appropriate for small samples.

This procedure made it possible to assess the normality of the data and ensure the validity of subsequent analyses, ensuring that the conclusions obtained accurately reflect the real effects of the implementation of the occupational health and safety management system in the organization.

Hypothesis Statement

H0: The implementation of the ISO 45001 standard reduces labor incidents without consequences in workers of a real estate company in Lima during the year 2025. They have a normal distribution.

Ha: the implementation of the ISO 45001 standard does not reduce labor incidents without consequences in workers of a real estate company in Lima during the year 2025. They have a normal distribution.

Table 7. Normality test data of incidents without consequence Pre Test – Post Test **Source:** Own elaboration

Shapiro - Wilk			
Normality test	Statistical	Gl	Significance
Inconsequential Incidents – Before	0.926	12	0.311
Incidents without consequence – After	0.871	12	0.061

Table 6 indicates that the significance for inconsequential incidents before was 0.311 and after 0.061; As both values are greater than 0.05, the data show a parametric behavior. Therefore, Student's T-test was applied to test hypotheses.

Specific Hypothesis Testing: Incidents without consequence

H_0: The implementation of the ISO 45001 standard does not reduce labor incidents without consequences in workers of a real estate company in Lima during the year 2025.

H_a: The implementation of the ISO 45001 standard reduces labor incidents without consequences in workers of a real estate company in Lima during the year 2025.

In order to achieve a correct statistical verification, the Student's t-test was carried out to evaluate the records obtained before and after the application of the ISO 45001 Standard using the p-value (significance level) as a decision criterion.

This analysis assesses whether there are significant differences between the averages of inconsequential incidents in both periods. The corresponding hypothesis should have been raised for the purposes of contrasting the average values and really knowing the importance of the application of the management system on the reduction of work incidents in the organization.

Null hypothesis (H0): The mean value of inconsequential incidents before implementation is greater than or equal to the average value collected after deployment.

Alternative hypothesis (Ha): The average value of inconsequential incidents before implementation is higher than the average value after implementation.

Table 8. Comparison of matched samples of incidents without consequence Pre Test – Post Test with the T Student statistic

Matched Sample Statistics				
	Average (%)	N	Desv. Deviation	Desv. Average error
Inconsequential Incidents – Before	60.33%	12	6.12458	1.76797
Incidents without consequence – After	35.42%	12	5.85136	1.68906

Source: Own elaboration

In Table 8, it can be seen that the average number of inconsequential incidents before implementation was 60.33%, and then it was reduced to 35.42%. therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which means that the implementation of the ISO 45001 Standard reduced the incidents without consequence in the workers of the Real Estate Consortium, Lima 2025.

Table 9. Student T Parametric Test Statistics for Inconsequential Incidents

Paired Sample Testing								
Paired differences								
	Stocking	Desv.	Desv. Average error	95% of the range of the CCA.		t	Gl	Sig. (bilateral)
				Inferior	Superior			
Inconsequential Incidents Before and After	-24.91000	8.79971	2.54026	-31.42000	-18.40000	-9.809	11	0.000

Source: Own elaboration

In the Student's T test, a significance value of 0.000 is shown, with a GIS < 0.05, interpreting we can mention that the alternative hypothesis is accepted and the null hypothesis is rejected. This confirms that the implementation of ISO 45001 improved safety management, significantly reducing incidents without consequence in the workers of the Real Estate Consortium, Lima 2025.

6. DISCUSSION

The findings of this research definitively demonstrate that the implementation of the ISO 45001:2018 Standard has led to a substantial reduction in labor incidents within the construction consortium under analysis. This outcome substantiates the efficacy of the management system as a preventative instrument and a catalyst for ongoing enhancement in hazardous environments. The total number of incidents decreased from 68 to 60. 25% to 28%. The data indicates a 57% decrease, with a 75% confidence interval. The findings indicated that 88% of the participants exhibited a p-value of 0.000, thereby substantiating the central hypothesis and underscoring the system's capacity to address the root causes that were identified in the preliminary assessment. These root causes encompassed deficiencies such as inadequate supervision, the presence of informal procedures, inadequate documentary control, and the absence of hands-on training. This pattern is replicated when examining the specific targets: the incidents that resulted in consequences decreased by 52. The initial percentage was 75%, and the final percentage was 31.92%, indicating a decrease of 39%. The study found a 49% reduction in incidents with repercussions (p = 0.000), while incidents without repercussions decreased by 60%. 33% to 35%. The proportion has decreased by 41%, representing a 42% decrease. The study found a 29% decrease in injury rates, indicating a significant advancement in injury prevention and the early identification of hazardous situations or actions. These results are largely consistent with those of other studies, including those conducted by Daoudi and Mendli (2025). The aforementioned study documented a 32% decrease in workplace incidents and a 28% increase in compliance with internal audits in medium-sized companies certified under ISO 45001. The authors attributed these achievements to the strengthening of participatory leadership and the creation of a culture of prevention. In a similar vein, Criollo et al. (2024) observed substantial declines in the frequency index (150.71 points) and the severity index (386.22 points) subsequent to the implementation of the standard. These findings are in alignment with the concurrent decrease in incidents accompanied by consequences, as evidenced by the present analysis. In a similar vein, Acosta et al. (2024) reported a 88.27% decrease in accidents and incidents, as well as a notable advancement in the preventive culture at the company Samitex S.A. These findings are also evident in the consortium studied, where continuous training, workplace supervision, and the formalization of operating procedures generated a significant change in the safe practices of employees. Conversely, Aybar et al. (2023) reported a reduction in accidents of over 90% in a small construction company following the implementation of ISO 45001. This outcome aligns with the observed pattern in this study, wherein the standardization of preventive measures and the enhancement of internal communication led to heightened commitment among operational personnel. Moreover, research such as that of Almanza et al. (2022) demonstrated a 78.72% decrease in accidents and a 92% increase. A substantial proportion of respondents expressed high levels of job satisfaction, with 86% in favor of the notion that ISO 45001 fosters systemic transformation by integrating leadership, active participation, and operational control. In a related finding, Martínez et al. (2021) observed that the implementation of the standard resulted in a notable increase in compliance with the OHS-MS, ranging from 21% to 65%. The study underscored the pivotal role of order, operational discipline, and continuous supervision in the reduction of incidents, a phenomenon that was exemplified in this consortium through the reinforcement of IPERC, work permits, and corrective action plans. Moreover, the findings of this study demonstrate that ISO 45001 impacts not only operational indicators but also fosters a transformation in organizational culture, thereby encouraging greater collective responsibility, more advanced risk management, more active leadership, and better internal communication. Consequently, these factors contribute to the creation of a safer, more stable, and productive work environment. The findings indicate that the concurrent decrease in both incidents with and without consequences validates the efficacy of the standard in addressing both critical events and near misses. This outcome strengthens the capacity for operational supervision and consolidates a comprehensive prevention model that prioritizes sustainability, workplace well-being, and compliance with the health-related Sustainable Development Goals. The model underscores the significance of safety and decent work.

7. CONCLUSIONS

The findings of the analysis indicate that the adoption of the ISO 45001:2018 Standard had a significant impact on the reduction of labor events in the real estate consortium under study. A notable decrease of 68.25% to 28.75% was observed, which corresponds to a reduction of 57%. The efficacy of the implemented system is confirmed by the statistical significance of p = 0.000, which indicates that 88% of the participants exhibited a positive response. This effect was consistently detected in the two areas analyzed: incidents with consequences were reduced from 52. The initial percentage was 75%, and it subsequently decreased to 31.92%, indicating a 39% reduction. Forty-nine percent of the cases resulted in consequences, while incidents without consequences accounted for less than 60 percent. 33% to 35. The percentage has decreased by 41%, with the current figure standing at 42%. The findings indicate a statistically significant direct impact of the standard on the strengthening of operational control, the adoption of preventive behaviors, and the reduction of both injuries and potentially dangerous situations. This impact is observed in both cases, with a p-value of 0.000. The implementation of ISO 45001 principles, including risk identification, hazard assessment, constant monitoring, standardization of procedures, continuous training, and effective use of protective equipment, has been identified as a significant factor in the observed changes in organizational culture. This implementation has been shown to stimulate more motivated leadership, improve internal communication, and consolidate safer and more sustainable practices at all levels of the company. Moreover, the findings of this study are consistent with those of national and international research that has reported analogous effects. This finding serves to reinforce the external validity of the study and demonstrates that ISO 45001 is an effective tool for preventing incidents, improving preventive management, and optimizing operational performance in organizations in the construction sector. The extant literature suggests that the implementation of ISO 45001 has the potential to reduce workplace incidents in a measurable way. Furthermore, it has been demonstrated that ISO 45001 can transform safety culture, improve the work environment, and contribute directly to the achievement of Sustainable Development Goals related to decent work, health and well-being. This suggests that ISO 45001 is an essential strategy for high-risk work environments.

REFERENCES

ACOSTA, Arturo and MENESES, Marcos. Implementation of the ISO 45001:2018 standard to improve health and safety management in the company Samitex S.A. Lima: Universidad Ricardo Palma, Faculty of Engineering, Professional School of Industrial Engineering, 2024.

ALMANZA, J. and OCHOA, C. Proposal for the occupational health and safety system based on the ISO 45001:2018 standard to reduce occupational risks in a metalworking company. Lima: Universidad Ricardo Palma, 2022.

ANSI. International Standards and Conformity Assessment. [S.l.]: Interamerican Coalition for Regulatory Convergence in the Medical Technology Sector, 2020.

ARIAS, Fidias. The research project: introduction to scientific methodology. Caracas: Episteme, 2012. ISBN 978-980-07-8529-4.

ARIZAPANA, José. Implementation of the safety management system based on the ISO 45001:2018 standard for the mining company EMITMA S.R.L. Ananea. Puno: Universidad Nacional del Altiplano, Faculty of Mining Engineering, 2020.

AYBAR, Luciana and GARCÍA, Juan. Implementation of SGSST-ISO 45001:2018 for the reduction of accidents in an MSEs in the construction sector. Trujillo: Ciencia Latina: Revista Científica Multidisciplinar, 2023.

BENITES, Nelva and MORALES, José. Application of industrial safety based on the G-050 standard for the prevention of accidents on site, of a construction company. Trujillo: César Vallejo University, 2023.

BERNAL, César. Research methodology: for management, economics, humanities and social sciences. Mexico: Pearson Education, 2010.

BETANCUR, C. Design of improvements in occupational health and safety management based on ISO 45001:2018 in a recyclable materials recovery company. [S.l.]: Universidad de Concepción, 2021.

LIMA CHAMBER OF COMMERCE. The construction sector would have a growth of 4% this year. Lima: [s.n.], 2024.

ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN (ECLAC). Employment situation in Latin America and the Caribbean: challenges and opportunities for the labor inclusion of young people and the redistribution of care work. Santiago: ECLAC, 2023.

CRESWELL, John and CRESWELL, J. David. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. [S.l.]: SAGE Publications, Inc, 2018. ISBN 978-1-5063-8670-6.

CRIOLLO, Edwin, et al. Industrial safety management according to ANSI Z-49.1 standard to reduce incidents in a metalworking company. Lima: FIGEMPA: Investigación y Desarrollo, 2024.

CUSICHE ENRÍQUEZ, A. G. and TAIPE MARTÍNEZ, S. S., 2023. Implementation of the ISO 45001:2018 standard and its influence on the reduction of occupational accidents in the contractor company Los Andes Construcciones y Servicios S.A.C. – Compañía Minera Alpayana S.A., Huarochirí, Lima 2022. Undergraduate thesis. Lima: National Technological University of South Lima.
https://repositorio.untels.edu.pe/handle/20.500.12970/932

FREMAP. Guide for the implementation of ISO 45001. [S.l.]: FREMAP, 2018.

GONZALES. Methodology of scientific research: a practical guide. [S.l.], 2021.

HERNÁNDEZ, Roberto; FERNÁNDEZ, Carlos and BAPTISTA, Pilar. Research methodology. Mexico: McGraw-Hill, 2014. ISBN 978- 607-15-0905-3.

HERNÁNDEZ, Roberto; FERNÁNDEZ, Carlos and BAPTISTA, Pilar. Research methodology. 7th ed. Mexico: McGraw-Hill, 2014. ISBN 978-607-150-291-9.

HOBSBAWM, Eric. The Age of Revolution: Europe 1789–1848. London: Abacus, 2008. ISBN 978-0349104843.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO). ISO 45001:2018. Occupational health and safety management systems – Requirements with guidance for use. Geneva: ISO, 2018.

LLOYD'S REGISTER FOUNDATION. World Risk Poll 2024 Report: What the World Worries About: Global Perceptions and Experiences of Risk and Harm. London: Lloyd's Register Foundation, 2024.

MAR, Naila. Implementation of the ISO 45001 standard in a water operating company. Nuevo León: Universidad Autónoma de Nuevo León, 2020.

MARTÍNEZ, Carlos; ACOSTA, Iván and MAIGUALEMA, Ángel. Implementation of an occupational health and safety management system under the international standard ISO 45001:2018 applied to the operational processes of the company Balanced Nutritious. Ecuador: Universidad Técnica de Ambato, 2021.

MINISTRY OF HOUSING, CONSTRUCTION AND SANITATION. National Building Regulations (RNE). Lima: MVCS, 2021.

MORALES, Miriam. Safety management to standardize safe processes under the ISO 45001:2018 standard in Peruvian microenterprises. Lima: BIOTECH & ENGINEERING, 2024.

MOTA, Freisy and SEMINARIO, Milagros. Implementation of the ISO 45001:2018 Standard to improve occupational health and safety in the company Fyser Group. Lima: Universidad San Ignacio de Loyola, 2023.

INTERNATIONAL LABOUR ORGANIZATION (ILO). Occupational safety and health: a comprehensive approach. Geneva: ILO, 2020.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION. ISO 5001:2018: Occupational Health and Safety Management Systems – Requirements with guidance for their use. [Online]. 2018. Available in: https://www.iso.org/

INTERNATIONAL LABOUR ORGANIZATION. Safety and health at the heart of the future of work: Leveraging 100 years of experience. Geneva: ILO, 2019. ISBN 978-92-2-133155-1.

RCR PERU. Five construction workers die every month on formal construction sites. Lima: RCR Peru, 2024.

REAL, Isael. The justification for your research. Puerto Rico: University of Puerto Rico, Faculty of General Studies, 2024.

REASON, James. Managing the Risks of Organizational Accidents. Aldershot: Ashgate, 1997. ISBN 978-1-84014-105-4.

TRIOLA, Mario. Introduction to statistics. 14th ed. Mexico: Pearson. Education, 2023. ISBN 978-607-324-378-0.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO). ISO 45001:2018. [online]. Geneva: 2025. [Accessed: 24 September 2025]. Available in: https://www.iso.org/standard/63787.html

United Nations Development Programme (UNDP). Goal 8: Decent work and economic growth. [online]. New York: UNDP 2025. [Accessed: 24 September 2025]. Available in: https://www.undp.org/es/sustainable-development-goals

WALLIMAN, Nicholas. Research methods: The basics. Routledge, 2021

KIRSTEN, Wolf. The evolution from occupational health to healthy workplaces. American Journal of Lifestyle Medicine, 2024, vol. 18, no. 1, p. 64-74

SWUSTE, Paul, et al. From safety to safety science: The evolution of thinking and practice. Routledge, 2021.

THOMAS, C. George; THOMAS, C. George. Research methodology and scientific writing. Thrissur: Springer, 2021.

TERRELL, Steven R. Writing a proposal for your dissertation: Guidelines and examples. Guilford Publications, 2022.

INTERNATIONAL LABOUR ORGANIZATION. Guidelines for occupational safety and health management systems ILO-OSH 2001. Geneva: ILO, 200