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Enhancing Safety Induction Programs in Malaysia's Oil and Gas Sector: A Comprehensive Review of Best Practices and Strategic Recommendations

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Abstract

The study highlights the crucial role of leveraging advanced technologies, such as multimedia presentations and interactive simulations, in enhancing engagement and retention within safety training programs. This research involved a comprehensive analysis of participants from various job roles in the oil and gas sector, ensuring a diverse and representative perspective on the impact of these programs. The findings emphasize the necessity of optimizing technological integration, catering to diverse learning styles, and implementing mentorship systems to facilitate new employees' seamless integration into the safety culture. Additionally, the study underscores the effectiveness of regular safety challenges and quizzes in reinforcing critical safety concepts and promoting continuous learning. The analysis reveals significant positive correlations between several key factors: program design and employee engagement ($r = 0.582$, $p < 0.001$), organizational support and overall satisfaction ($r = 0.645$, $p < 0.001$), and participant characteristics and information retention ($r = 0.489$, $p < 0.001$). These results demonstrate the importance of well-structured, engaging, and interactive safety induction programs, supported by a strong commitment from the organization. The study provides actionable recommendations for enhancing the effectiveness of these programs, aiming to improve safety performance, increase employee satisfaction, and reduce the incidence of workplace accidents and injuries. Ultimately, this research offers valuable insights into best practices for the development and enhancement of safety induction programs, which are essential for fostering a robust safety culture within organizations. Continuous improvement of these programs is vital for protecting employees, enhancing operational efficiency, and contributing to the organization's overall success.

Keywords: *Employee Engagement, Oil and Gas Sector, Safety Culture, Safety Induction Programs, Technology Integration, Training Effectiveness, Workplace Safety.*

Introduction

Malaysia's involvement in the oil and gas sector began in 1910 with the discovery of oil in Miri, Sarawak [6]. This discovery led to significant foreign investment and the development of additional oil fields in Sarawak during the 1960s, attracting major companies like Shell, Schlumberger, Esso, and Conoco. Under the Continental Shelf Act of 1966, these companies were granted concessions, contributing to Malaysia becoming the second-largest oil producer in Southeast Asia and the third-largest exporter of liquefied natural gas (LNG) globally by 2020 [6].

The oil and gas sector is crucial to Malaysia's economy, driving income and energy security through exploration, production, and refining activities. However, the industry's inherently hazardous operations

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underscore the importance of robust safety measures. Given the high-risk nature of these operations, the implementation of effective safety induction programs is critical for minimizing risks and ensuring worker safety. Despite their significance, the efficacy of these programs in the oil and gas sector remains under-examined, highlighting a crucial gap in the industry's safety practices.

Drilling and extracting oil and gas presents numerous risks to human life and the environment. Explosions and fires can have an instantaneous impact on an offshore facility and the workers within it (offshore rigs can be destroyed or damaged along with installed equipment by fire and/or explosions while staff can be injured or killed), and hydrocarbon releases can have severe and lasting effects on the environment, affecting humans and wildlife within a large radius surrounding the area directly [3]. Major accident causes might include defects in materials, structures, and machinery, as well as human and procedural errors brought on by inadequate training and other factors [3]. Significant hazards are associated with petroleum activities, such as the potential for fires, explosions, and hydrocarbon leaks that could result in a catastrophic event [18]. As in many significant accident cases, fatal accidents frequently entail complicated, multi-attribute occurrences brought on by a variety of human, technological, and organizational elements [18]. In today's fast-paced and dynamic work environments in the oil and gas industry in Malaysia, the safety and well-being of employees are of paramount importance. Workplace accidents and injuries not only lead to personal suffering but also result in significant financial losses for organizations.

According to the Department of Statistics Malaysia (DOSM) [5], the manufacturing sector reported 7,994 cases of occupational injuries in 2021, followed by Services with 4,299 cases, Construction with 2,297 cases, and Wholesale and Retail Trade with 1,979 cases. All industries showed a decline in occupational injuries compared to the previous year, except for mining and quarrying [5]. The oil and gas industry incidents fall under this category. Manufacturing had the highest rate of occupational injuries in 2021, with 3.20 cases per 1,000 workers, followed by Construction (1.98) and Utilities (1.95). The hotel and restaurant sector reported the fewest injuries, with 0.18 cases per 1,000 workers [4]. The only sector that showed an increase in 2021 was mining and quarrying, rising from 1.48 to 1.90 cases per 1,000 workers. The data reveals that, except for specific industries, all sectors experienced a reduction in fatal occupational injuries in 2021. Mining and quarrying saw an increase in fatal injuries from 3.65 in 2020 to 10.98 per 100,000 workers in 2021. Similarly, utilities rose from 1.87 to 4.90, transport, storage, and communication from 1.42 to 4.26, and finance, insurance, real estate, and business services from 1.56 to 2.78. Mining and quarrying had the highest fatality rate, reporting 10.98 per 100,000 workers in 9 cases, as illustrated in Figure 1.1.

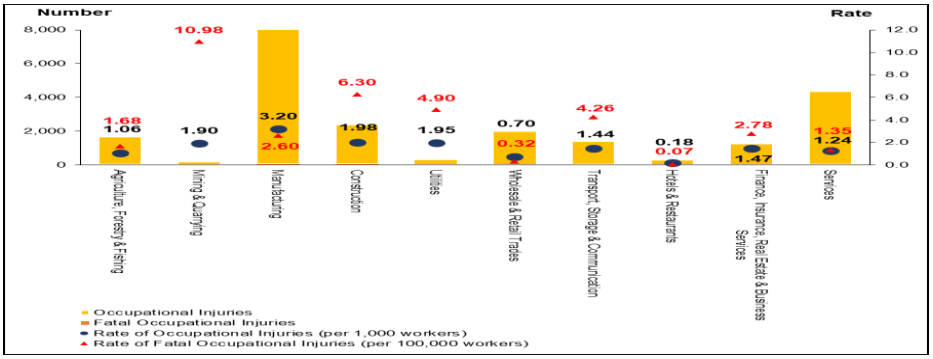

Figure 1. Occupational Injuries and Fatal Occupational Injuries by Sector Act 514, 2021[4].

Given the hazardous nature of oil and gas operations, effective safety induction programs are critical to minimizing risks and ensuring worker safety, yet their efficacy remains under-examined in this sector.

Research Background

The oil and gas sector in Malaysia faces distinct challenges that necessitate rigorous safety induction programs. Due to the high-risk environment, complex machinery, and diverse workforce, the effectiveness of these programs is critical to ensuring the safety and well-being of employees. Safety induction programs are not only essential for familiarizing new hires with organizational safety procedures, hazards, and emergency protocols but also for keeping existing employees up to date with any procedural changes.

Several sector-specific challenges underscore the need for tailored safety training:

1. **Lack of Engagement:** Safety induction programs can often become monotonous, especially when content is recycled year after year, leading to employee disengagement. According to Mullins, Blair, and Dunlap (2019), employees who have suffered workplace injuries often report low engagement levels and a lack of adherence to safety procedures [9].
2. **Language Barriers:** The sector's diverse workforce, with varying language proficiencies, often leads to communication challenges. The International Labour Organization (2016) has highlighted that language issues can significantly impede the safety and health of migrant workers [17, 20].
3. **Generic Content:** Using generic content in safety induction programs may fail to address the specific hazards and risks present in different job roles and work environments. Tailored programs, as recommended by Tupavali (2017), are crucial for effective safety training [16].
4. **Lack of Hands-On Training:** Without interactive elements, such as practical demonstrations or simulations, safety induction may leave employees underprepared for real-life scenarios. Hands-on training is often more effective than theoretical instruction alone.
5. **Overemphasis on Paperwork:** While compliance is critical, overemphasizing paperwork can detract from the core safety values and attitudes that need to be instilled in employees. Turner (n.d.) argues that an excessive focus on paperwork can hinder the engagement and understanding of safety principles [15].
6. **Failure to Address Psychological Factors:** Factors such as stress, fatigue, and complacency are often overlooked in safety induction programs. Choudhry and Fang (2008) found that these psychological and organizational factors contribute to risky behaviour among workers [4].
7. **Lack of Evaluation and Follow-Up:** Ongoing evaluation and follow-up are vital for ensuring the effectiveness of safety induction programs. Pui Teck and Mohd Asmoni (2015) suggest that engaging follow-up training could improve comprehension by exposing learners to real-world scenarios [12].
8. **Resistance to Change:** Experienced workers may resist safety induction programs, believing they are already well-versed in necessary safety procedures. Convincing such employees of the importance of ongoing safety training can be challenging. Arbin et al. (2021) explore this resistance as a significant factor in the effectiveness of safety programs [2].
9. **Outdated Training Materials:** The use of outdated materials in safety induction programs can diminish their relevance and effectiveness. McCrie and Lee (2022)

emphasize the importance of continuously updating training content to reflect current safety standards and practices [8].

Problem Statement

In most organizations, health and safety training is an essential component of preventive programs that begin with induction/orientation after hiring new employees or departmental transfers. The goal is to provide employees with the skills, knowledge, and expertise they need to perform assigned tasks safely and increase productivity [10]. Safety induction programs serve as an important foundation for building strong safety practices and cultures within organizations. However, these programs face critical shortcomings and challenges in achieving their effectiveness, especially in the context of the oil and gas sector.

Mayhew et al. (1997) discovered that the main factor influencing the patterns of work-related injuries in four industries was exposure to risks and hazards specific to the jobs [7]. Current safety induction programs often use a generalized approach across the organization, which fails to cater to the diversified job roles within the oil and gas sector. A study conducted by Pinto et al. (2020) discusses the importance of improving workers' technical skills and emphasizes the need for tailored safety induction programs to address specific hazards and responsibilities within the oil and gas sector [11].

The generalized approach of delivering safety induction programs across the organization fails to prepare employees to navigate safety concerns related to their specific job roles. It overlooks the distinct safety hazards, practices, protocols, and responsibilities specific to each job role. In addition, there are inconsistencies in the comprehensiveness, delivery modes, and content of safety induction programs within the organization. According to Vecchio-Sadus and Griffiths (2004) and Whitaker et al. (2003), more emphasis should be placed on incorporating task-specific and current hazards rather than generic ones that workers may already be familiar with, such as site rules, site-specific hazards, and processes for reporting incidents and accidents [17, 19].

The differences in relevant information, depth, and duration of these programs influence the effectiveness of delivering crucial safety knowledge to participants. For example, Rutaihwa (2013) observed a lack of seriousness regarding the training program's schedule and content, noting that there are often unrealistic expectations placed on new hires [13]. This gap in preparation can impact workplace safety practices, behaviours, and culture, potentially leading to an increase in occupational hazards, accidents, and injuries.

Moreover, safety induction programs fail to harness advancements in technology and update safety practices and standards promptly. Snell (2006) offers a more comprehensive understanding of induction as the process of integrating people, procedures, and technology to maximize the impact of recruits on business results [14]. The lack of regular updates in safety induction programs leaves them obsolete in addressing the latest safety concerns and information, leaving employees unaware of the most current safety protocols and updates within the sector.

Therefore, this study will address the issues related to safety induction programs by developing strong safety practices and cultures, mitigating workplace incidents, and ensuring that employees in the sector are equipped with the relevant knowledge and information to handle safety in a high-risk environment, such as the oil and gas industry.

By addressing these research objectives, the study aims to offer valuable insights into best practices for safety induction programs and provide actionable recommendations to enhance workplace safety and foster a strong safety culture within the target industry or workplace. The research objectives are:

1. Assess the impact of interactive, role-specific safety training modules on knowledge retention among oil and gas workers.
2. Evaluate the role of organizational support in enhancing employee engagement during safety induction programs.
3. Evaluate the effectiveness of different delivery methods and approaches used in safety induction programs.
4. Develop recommendations for enhancing the effectiveness of safety induction programs based on the findings.

Safety induction programs serve as fundamental pillars for ensuring workplace safety across various industries, particularly in high-risk sectors like oil and gas. These programs are indispensable as they usher employees, including both recruits and contractors, into the organization's safety ecosystem. Through safety induction, individuals are acquainted with critical safety protocols, potential hazards, and emergency procedures essential for their well-being and that of their colleagues. The significance of a well-structured safety induction program extends beyond immediate accident prevention. It also contributes to nurturing a robust safety culture within an organization. A strong safety culture is a bedrock for sustaining a safe work environment, fostering employee compliance with safety protocols, and enhancing overall engagement in safety practices.

Technological Innovations in Safety Training

This section explores how technological advancements, such as multimedia presentations and interactive simulations, are being integrated into safety induction programs. These innovations aim to enhance engagement, retention, and the overall effectiveness of safety training by making the content more accessible and interactive for employees.

Challenges in Safety Program Engagement

This section discusses the various barriers to employee engagement in safety training programs, such as language barriers, monotonous content, and lack of hands-on training. It also examines how these challenges can lead to disengagement and suboptimal safety outcomes, emphasizing the need for tailored approaches to address these issues.

Sector-Specific Risks in Oil and Gas Safety

Focusing on the unique hazards of the oil and gas sector, this section highlights the importance of specialized safety training that addresses the specific risks associated with this industry. It discusses how safety induction programs must be designed to mitigate these risks effectively, ensuring that employees are well-prepared to handle the complexities of the work environment.

Impact on Organizational Safety Culture and Compliance

This section examines the broader impact of safety induction programs on an organization's safety culture and regulatory compliance. It discusses how well-implemented programs contribute to a proactive safety culture, where employees are not only compliant with safety protocols but are also actively engaged in promoting and maintaining safety standards within the organization.

Methodology

Analysing safety induction programs is crucial to ensure their effectiveness in promoting a safe and secure work environment. This section outlines the structured methodology used to assess the effectiveness of these programs and to make informed recommendations.

1. **Theoretical Framework**
   - **Dependent Variable**: The effectiveness of the safety induction program.
   - **Independent Variables**: Program design, organizational factors, and participant characteristics.
2. **Research Design**
   - The research was carefully designed to assess safety induction programs, involving defining the research title, objectives, and significance. This included conducting a literature review to support the study and developing a methodology that aligns with the research goals.
3. **Data Collection Method**
   - Data were collected using a structured survey. The survey comprised 20 Likert-scale items designed to quantitatively measure participants' perceptions of the safety induction programs. Additionally, 5 open-ended questions were included to gather qualitative insights. The survey was distributed to employees across various roles in the oil and gas sector to obtain a broad understanding of the program's impact.
4. **Scope of Research:**
   - The research targeted companies operating in the oil and gas sector in Miri, Sarawak. It included a range of company sizes and activities, such as exploration, production, drilling, refining, and distribution, to capture a full spectrum of operational scales and safety practices.
5. **Sampling Procedures:**
   - Stratified random sampling was used to ensure diverse representation across different job roles and experience levels. Participants who had undergone safety induction training were randomly selected. The sample included new employees, contractors, and existing employees, providing a comprehensive view of the program's effectiveness.
6. **Data Analysis:**
   - The quantitative data from the Likert-scale items were analyzed using statistical methods, including descriptive statistics and correlation analysis, to identify patterns and relationships between program design, organizational factors, participant characteristics, and the effectiveness of safety induction programs. The qualitative responses from the open-ended questions were reviewed to extract additional insights, which were then summarized to complement the quantitative findings.

Results

Findings and Discussion

This study utilized IBM SPSS Statistics 27 for various data analyses, including descriptive statistics, Pearson correlation analysis, and a one-sample t-test, to evaluate the effectiveness of safety induction programs in the oil and gas sector. The findings are discussed in detail below, providing critical insights into the key factors influencing the success of these programs.

Demographic Analysis

The demographic analysis showed that the majority of respondents were safety officers (33.3%), followed by site safety supervisors (12.1%) and safety managers (9.1%). Other roles, including administrative personnel, engineers, managers, and supervisors, each represented 6.1% of the respondents, while roles such as operations excellence executives and technicians accounted for a smaller percentage (3%). This diverse distribution is essential for understanding the varied perspectives on safety induction programs across different job roles. The representation from multiple roles ensures that the findings

are comprehensive and reflect the real-world diversity of experiences within the industry.

Summary Statistics

Descriptive statistics provided a summary of the respondents' demographic characteristics, job roles, and their completion of safety induction programs. The data revealed that a significant majority (84.8%) had undergone safety induction training, indicating a high compliance level with organizational safety protocols. The completion rates across different years also highlighted the ongoing commitment to safety training within the sector, with most respondents completing their training recently, in 2023. This suggests a strong emphasis on keeping the workforce updated with current safety practices.

Data Analysis

Pearson's Correlation Analysis

The Pearson correlation analysis examined the relationships between key variables affecting the effectiveness of safety induction programs. The results are summarized below:

Table 1. Pearson Correlation Coefficient (r) According to the Effectiveness of Safety Induction Program

Variable	Correlation Coefficient (r)	Significance (p-value)
Program Design vs. Engagement	0.582	<0.001
Organizational Support vs. Satisfaction	0.645	<0.001
Participant Characteristics vs. Retention	0.489	<0.001

The analysis revealed significant positive correlations between the following variables:

- **Program Design and Engagement:** The correlation coefficient of 0.582 ($p < 0.001$) indicates a moderate yet significant relationship between program design and employee engagement. This suggests that while the design of safety induction programs plays a crucial role in engaging employees, it is not the sole factor. Other elements, such as the delivery method and individual participant characteristics, may also significantly impact engagement. This finding implies that a one-size-fits-all approach to program design may not be sufficient, and further research is needed to explore how different design elements contribute to varying levels of engagement.
- **Organizational Support and Satisfaction:** With a correlation coefficient of 0.645 ($p < 0.001$), the analysis shows a strong positive relationship between organizational support and employee satisfaction with safety induction programs. This finding underscores the importance of organizational commitment to safety, as employees who perceive strong support from their organization are more likely to be satisfied with their training. This could be due to the perception that the organization values their safety, which in turn fosters a positive attitude towards the training provided.
- **Participant Characteristics and Retention:** A correlation coefficient of 0.489 ($p < 0.001$) highlights a moderate positive relationship between participant characteristics, such as prior experience and educational background, and their retention of safety information. This suggests that employees with relevant experience or higher educational levels are better able to retain the safety information provided during induction programs. This finding is critical for tailoring programs to suit different employee groups, ensuring that all participants, regardless of background, can effectively retain and apply safety knowledge.

One-Sample T-Test

The one-sample t-test evaluated specific aspects of safety induction programs, revealing significant insights:

- **Need to Optimize Technology Use:** Advanced technology, such as multimedia presentations and interactive simulations, significantly enhances the effectiveness of safety induction training ($p < 0.001$). This finding suggests that incorporating modern technological tools can make training more engaging and impactful, particularly for a workforce that may be accustomed to digital interactions.
- **Address Diverse Learning Styles:** The importance of catering to diverse learning styles and preferences was also confirmed ($p < 0.001$). Safety induction programs that incorporate a variety of instructional methods—such as visual, auditory, and kinesthetic approaches—are more likely to meet the needs of a diverse workforce, thereby improving the overall effectiveness of the training.
- **Implement a Mentorship System:** The implementation of a mentorship system, where experienced employees guide new hires, was found to have a significant positive impact on the integration of new employees into the safety culture ($p < 0.001$). This finding highlights the value of personal guidance in reinforcing safety principles, making it easier for new employees to adapt to the safety practices of the organization.
- **Develop Regular Safety Challenges and Quizzes:** Incorporating regular safety challenges and quizzes into safety induction programs was shown to reinforce key safety concepts and promote continuous learning ($p < 0.001$). This approach helps keep safety information fresh in the minds of employees and encourages ongoing engagement with safety practices.
- **Focus on Employee Engagement:** Actively engaging employees in safety discussions and providing opportunities for participation were found to be crucial for promoting a proactive safety culture ($p < 0.001$). The findings suggest that engagement is not just about the content of the training but also about how employees are involved in the process, which can lead to a more committed and safety-conscious workforce.

Sampling Process and Validity

Participants in this study were selected using a stratified random sampling method, which ensured representation across different job roles and experience levels within the oil and gas companies surveyed. This method enhances the validity of the study by minimizing selection bias and ensuring that the sample is representative of the broader population within the industry. Stratified random sampling is particularly useful in heterogeneous populations like the oil and gas sector, where different job roles might have different experiences and perspectives on safety induction programs.

Implications and Need for Further Research

The study's findings provide a robust foundation for enhancing safety induction programs. However, the moderate correlations found in some areas, such as the relationship between program design and engagement, suggest that other factors may also influence the effectiveness of these programs. These could include variables not directly measured in this study, such as the specific content of the training or the personal attitudes of employees towards safety. Additionally, the feedback indicating that some respondents found the programs monotonous highlights the need for more varied and interactive training

methods to maintain engagement. Future research should explore these areas in more detail to provide a more comprehensive understanding of how to optimize safety induction programs.

The findings of this study underscore the importance of a multifaceted approach to safety induction programs in the oil and gas sector. While well-designed programs that incorporate modern technology and address diverse learning styles are essential, organizational support and tailored approaches for different participant groups also play critical roles in the success of these programs. The insights gained from this research provide valuable guidance for organizations seeking to improve their safety training, though further research is needed to fully understand the complex dynamics at play.

Discussion

Based on the findings, the following recommendations are proposed to enhance the effectiveness of safety induction programs. These recommendations are structured by priority and the areas they impact, ensuring clarity and strategic implementation.

Short-Term Recommendations

1. **Optimize Technology Use:**
   - **Leverage Advanced Technology:** Safety induction programs should incorporate advanced technological tools such as multimedia presentations and virtual reality (VR). These tools can simulate real-life scenarios, allowing employees to experience potential hazards in a controlled environment. Interactive elements like simulations can significantly enhance engagement and retention of safety information.
   - **Blended Learning:** Implement a blended learning approach that combines online modules with face-to-face sessions. This method caters to different learning preferences, ensuring that participants can engage with the material in ways that suit them best. Abeni (2020) and McGrath (2009), both explained the use of interactive elements like case studies and real-life scenarios in learning programs [1, 8].
2. **Address Diverse Learning Styles:**
   - **Cater to Multiple Learning Preferences:** Safety induction programs should accommodate various learning styles—visual, auditory, and kinesthetics. Ensure training material includes diagrams, videos, discussions, and hands-on activities to cover all learning preferences.
   - **Regular Content Updates:** Regularly update training material to reflect the latest safety practices and industry standards, keeping content relevant and engaging.
3. **Implement a Mentorship System:**
   - **Mentorship Programs:** Establish a mentorship or buddy system where experienced employees mentor new hires. This system not only helps integrate new employees into the company's safety culture but also provides them with ongoing support and guidance.

Long-Term Recommendations

4. **Focus on Leadership and Engagement:**
   - **Leadership Commitment:** Leadership plays a critical role in fostering a safety culture. Leaders should actively participate in safety programs and model safety behaviours, setting a positive example for all employees.
   - **Employee Engagement:** Encourage active participation in safety discussions and workshops. Create platforms for employees to share their

experiences, suggest improvements, and discuss safety practices.

5. **Continuous Evaluation and Improvement:**
   - **Feedback Mechanism:** Develop a robust feedback mechanism for continuous improvement of safety induction programs. Collect and act on participant feedback regularly.
   - **Periodic Content Updates:** Ensure the safety induction content is periodically updated to reflect the latest industry standards and technological advancements.

Addressing Potential Barriers

- **Budget Constraints:** Implementing advanced technological solutions may face financial hurdles. Consider phased implementation strategies and seek external funding to support these initiatives.
- **Resistance to Change:** Employees, particularly those with extensive experience, may resist new training methods. Involve them in the development process and provide clear explanations of the benefits to ease the transition.

By implementing these recommendations, organizations can create more effective safety induction programs that enhance workplace safety and foster a strong safety culture. This proactive approach will lead to improved safety performance, higher employee satisfaction, and a reduction in workplace accidents and injuries.

Conclusion

This study highlights the critical importance of safety induction programs, particularly in high-risk sectors like the oil and gas industry. The findings reveal that while technological tools such as multimedia presentations and interactive simulations can greatly enhance engagement, the overall success of safety induction programs also depends on strong leadership and a robust safety culture.

The study's results show that regular safety challenges and quizzes, along with active engagement in safety discussions, are crucial for maintaining safety awareness. Continuous feedback and improvement loops ensure that safety induction programs remain dynamic and effective over time.

In conclusion, the continuous improvement of safety induction programs is essential for fostering a strong safety culture within organizations. By integrating advanced technology, addressing diverse learning needs, actively engaging employees, and ensuring strong leadership commitment, organizations can develop safety induction programs that are not only informative but also impactful. This comprehensive approach will protect employees, enhance operational efficiency, and contribute to the overall success of the organization.

The study also acknowledges potential barriers to implementing these recommendations, such as budget constraints and resistance to change. Addressing these challenges through phased implementation and involving employees in the development process can help overcome these obstacles. Continuous evaluation and adaptation of the programs are necessary to ensure their sustained relevance and effectiveness in a rapidly evolving industry landscape.

By committing to these strategies, organizations can ensure that their safety induction programs effectively prepare employees to navigate the hazards of their work environment, thereby reducing the incidence of workplace accidents and fostering a culture of safety that permeates all levels of the organization.

Conflict of Interest

There is no conflict of interest.

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