INTERNATIONAL JOURNAL OF LATEST TECHNOLOGY IN ENGINEERING, MANAGEMENT & APPLIED SCIENCE (IJLTEMAS)

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIII, Issue XII, December 2024

Evaluating the Effectiveness of Current Safety Practices and Sustainable Solutions in Reducing Construction Site Fatalities in North-West Nigerian Tertiary Institutions

Ismail Oladunni Muhammed and Basiru Muazu Namaiwa

Department of Building Technology, Federal Polytechnic, Kaura-Namoda, Zamfara State, Nigeria

DOI : https://doi.org/10.51583/IJLTEMAS.2024.131227

Received: 31 December 2024; Accepted: 08 January 2025; Published: 18 January 2025

Abstract: This paper aims to evaluate the current safety practices and their impact on the reduction of accidents and fatalities in construction sites in North-West Nigeria tertiary institutions. To achieve this aim, the study, through a survey design, draws a sample of forty-two respondents comprising a chief builder, director of works, physical planners and project supervisors using a convenience sampling technique. To obtain pertinent data, a 5-point Likert scale questionnaire was administered to participants and the collected data were analyzed using the relative importance index using the Statistical Package for Social Science (SPSS) version 17. However, findings from the analysis show that; the adoption of comprehensive and sustainable safety practices at construction sites significantly mitigates risks, safeguards the well-being of their workers, enhances project efficiency, and bolsters their overall reputation. Hence, there is a need for continuous improvement in safety standards, emphasizing proactive measures such as robust safety training and strict adherence to safety protocols. More so, integrating safety considerations into all phases of project management emerges as crucial for achieving sustainable safety outcomes.

Key words: Accidents and fatalities, safety practices, construction sites, Tertiary institutions, North-West Nigeria.

I. Introduction

The construction industry is a critical sector that aids infrastructural growth and development in any country. However, the industry is characterised by hazards like accidents and fatalities (Burn, 2019). These accidents often occur as a result of physical negligence or behavioural factors from unsafe practices by construction workers (Behm, 2005). Like many developing countries, the Nigerian construction industry faces safety challenges that lead to accidents and fatalities (Famakin et al., 2023). Therefore, safety practices within the industry are paramount to prevent accidents, safeguard the lives of workers and ultimately, ensure project delivery within the stipulated time (Singh & Misra, 2021). Despite the efforts to enforce safety practices, regulations and standards at construction sites, accidents still occur, stressing the need to re-evaluate the sustainability of safety practices (Vincoli, 2024). Specifically, the North-West states of Nigeria are faced with unique safety challenges at construction sites due to the upsurge in construction activities (Garba, 2022; Yar Adua, 2022). Research by Aiyewunmi (2023) revealed that the safety challenges in the region are due to the unique socio-economic and environmental factors coupled with the pace of construction.

This study aims to investigate the effects of the implementation of safety practices on construction project sites in tertiary institutions in the North-West of Nigeria and its impact on accidents and fatalities in the construction industry. However, the findings from this research are essential to improve the safety and well-being of construction workers and to ensure the timely and successful completion of construction projects in tertiary institutions. By focusing on the North-West region, the study aims to provide insights that are specific to the unique challenges faced in this area, thus enabling more targeted and effective interventions. Ultimately, the findings of this research will contribute to the body of knowledge aimed at enhancing safety practices in the Nigerian construction industry, thereby fostering sustainable development and progress.

II. Literature Review

The Concept of Accident, Fatalities and Safety Practices in Construction Sites

Safety is a fundamental human need (Robla-Gomez, 2017). According to Lizak & Etemova, 2023), safety comprises the state of being protected or the ability to survive and exist. Grzebieta, (2015) sees safety as a practical and legal requirement that involves the assessment and management of risks and harm. Safety practices are related to specific procedures and organisational culture. Manuele (2003) defines safety practices as part of organisational culture that outlines the principles and requirements for practice. Ind (2007) argued that safety practices are ingrained as managerial philosophy and not a mere visual display. However, Fowler & Tiemeyer (2006) assert that safety practices are beyond equipment reliability but involve a comprehensive process of assurance. These views show the complex nature and depth of the concept of safety practices, which highlight its importance in ensuring effective risk management and harm prevention.

Conversely, an accident is seen as an unexpected event that leads to unplanned costs that potentially alter organisational goals and affect their competitiveness in the industry (Asanka & Ranasinghe, 2015). According to Chan et al., (2018), accident at construction sites leads to damage to properties, injuries, and deaths caused by workers or construction companies themselves. Hamid et al., (2019) define accidents at construction sites as events that cause harm to workers, the community and the image of the sector resulting from non-compliance to safety regulations and safety practices rules.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIII, Issue XII, December 2024

On the other hand, fatalities in construction are severe situation that leads to death at sites (Marchiori et al., 2024). Similarly, Asanke & Ranasinghe (2015) define fatalities as a severe outcome of accidents that lead to loss of life. However, Martin et al., (2021) argued that fatalities are caused by human errors, negligence and the lack of awareness about safety practices. Apart from the loss of life that fatalities caused, they also result in financial loss and project delays (Chan et al., 2018). Hence, effective safety practices through education and training as well as comprehensive accident-cause analysis are important to minimize accidents and fatalities at construction sites (Oni, 2022)

Research by Tan (2014) revealed that the current safety practices in construction project sites include a range of measures such as safety policy, education and training, site safety inspection, safety auditing, safety meetings, site safety organization, personal protective equipment, emergency support, safety measuring devices, fall protective systems, and safety promotions. However, there are still challenges such as worker ignorance, lack of financial allocation, and language barriers (Tan, 2014; Kelwade, 2022). Effective safety training, budget allocation, and top management commitment are suggested strategies to address these issues (Tan, 2014). Specific safety management practices, such as safety committees, written safety policies, and safety training schemes, have been found to significantly impact project performance (Cheng, 2015).

Yusoff (2015) emphasizes the importance of safety practices in the construction industry to prevent accidents and reduce hazards. The study found that there is a need for improvement in safety practices to achieve the goal of zero accidents at construction sites. However, Azil's (2021) preliminary survey on safety practices at construction sites highlights the need for improved safety measures to protect the public. The study emphasises the importance of barricading entrances and exits to prevent public access, particularly in congested urban areas. This research is valuable for government agencies and industry bodies in identifying and implementing effective safety practices. Gambatese (2000) stressed the role of engineers and architects in improving construction site safety through design practices. These include scheduling to minimise nighttime and overtime work, setting up sites for simultaneous construction, and orienting projects to reduce work on steep slopes. More so, Razak (2012) provides a comprehensive review of safety practices at construction sites, identifying ten key areas including safety policy, education and training, safety inspection, and personal protective equipment. Giri (2023) conducted a study on safety management in public building construction in Pokhara Valley, Nepal. The research identified several key safety issues, including a lack of regular safety inspection, inadequate use of personal protective equipment, and a lack of safety training and policy. The study emphasised the importance of increasing worker safety awareness and implementing safe working practices through training and induction programs. These findings are crucial for the development of a project-based construction site safety policy.

In conclusion, ensuring safety practices in construction project sites is imperative for preventing accidents and minimising hazards. These findings collectively emphasise the critical role of proactive safety management in construction projects. By addressing safety issues comprehensively and implementing effective safety protocols, construction companies and government agencies can create safer work environments, reduce the risk of accidents, and protect the well-being of workers and the public alike.

Effect of Safety Practices on Construction Project Sites

Several studies have highlighted the importance of safety practices in construction projects, not only for worker well-being but also for cost-reduction and project success (Gambatese, 2000; Nagarajan, 2020; Forbes & Ahmed, 2010; Azil & Jabar, 2021). Design practices minimise the need for overtime work and allow simultaneous construction to improve safety (Gambatese, 2000), while risk management procedures and a hierarchy of risk control systems enhance safety and cut costs (Nagarajan & Ganapathi, 2024). Integrating safety concerns into project management is crucial for achieving greater value, lower costs, and reduced risks (Forbes & Ahmed, 2010). Specific safety practices like barricading entrances and exits to prevent public access are recommended to prevent accidents (Azil & Jabar 2021).

Moreover, a strong correlation exists between safety practices at construction sites and enhanced reputation and stakeholder trust (Chen et al., 2015). Lipinski et al., (2020) found that better safety management can improve reputation, although Azil & Jabar (2021) and Kent & Razak (2014) stress specific safety practices like barricading construction sites and implementing safety policies, education, and training to enhance safety and reputation. Similarly, studies explore safety practices and compliance with regulations at construction sites. Azil (2021) stresses the need for safety practices to prevent public accidents, particularly in congested urban areas. Lombardi et al., (2023) focus on compliance with safety and health measures, highlighting adherence to guidelines proposed by the Department of Safety and Health (DOSH). Kent & Razak (2012) identifies ten key safety practices, including safety policy, education, training, and personal protective equipment. Sulong et al. (2019) emphasise the cost of compliance with safety and health requirements, urging contractors to adhere to regulations to reduce accidents and maintain industry standards.

Furthermore, various studies underline the importance of safety practices at construction sites for workers and the public. Azil (2021) emphasises proper safety measures like barricading entrances and exits to prevent public accidents. Shamsuddin et al. (2022) highlight construction professionals' role in promoting safety awareness and creating a safe working environment. Ahmad et al. (2018) provide comprehensive overviews of safety practices, stressing safety policies, education, training, inspections, and personal protective equipment. These studies collectively highlight safety practices' critical role in construction projects for worker protection, environmental safety, and public well-being.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIII, Issue XII, December 2024

In conclusion, the importance of safety practices in construction projects, particularly within tertiary institutions in North-West Nigeria, cannot be overstated. Through a synthesis of various studies, it becomes evident that prioritising safety not only safeguards the well-being of workers but also contributes to project success, cost reduction, and enhanced reputation. Key safety measures such as proper design practices, risk management procedures, integration into project management, and specific protocols like barricading entrances are crucial for preventing accidents and ensuring public safety.

Moreover, compliance with safety regulations and adherence to best practices underscore the commitment to worker welfare and community development. The correlation between safety practices and reputation underscores the interconnectedness of safety, trust, and overall project success. By embracing comprehensive safety practices, institutions can foster a culture of safety, reduce accidents, enhance stakeholder trust, and contribute to broader goals of sustainability and social responsibility. Thus, prioritizing safety is not just a legal requirement but a moral imperative and a strategic investment in the well-being of workers, communities, and the institution itself.

Safety Management Theory

Safety management theory, proposed by James Reason in the late 20th century, provides a comprehensive framework for understanding and implementing safety practices in controlling fatalities on construction project sites (Fu et al., 2020). According to Reason's theory, safety management begins with the systematic identification of hazards and the assessment of associated risks, emphasising the importance of proactive measures to mitigate potential dangers (Xu et al., 2021). This approach stressed the necessity of fostering a strong safety culture within construction teams, where every individual feels empowered to prioritise safety above all else (Ni et al., 2023). Compliance with regulatory standards, such as those outlined by the Occupational Safety and Health Administration (OSHA), is central to safety management theory, as it ensures that safety practices align with established guidelines and requirements (Ajmal et al., 2022). Moreover, safety management theory emphasizes the critical role of ongoing safety training for workers, equipping them with the knowledge and skills necessary to recognize hazards and respond effectively in emergencies (Echavaria, & Espiritu, 2024). Strong safety leadership, as advocated by Reason, is also paramount, with project managers and supervisors setting clear safety objectives, providing resources for safety initiatives, and serving as role models for safe behaviours (Aridi et al., 2024; Bathan, 2023). By integrating safety management theory into daily operations, construction projects can create safer work environments, ultimately reducing the incidence of fatalities and ensuring the well-being of all workers involved.

Empirical Review on the Relationship between Safety Practices and Accidents and Fatalities in Construction Project Sites

Yusoff (2015) examined the importance of safety practices in the construction industry to prevent accidents and reduce hazards. Through the distribution of questionnaires to workers at construction sites to gather data on safety practices, the study found that there is a need for improvement in safety practices to achieve the goal of zero accidents at construction sites. This stressed the significance of implementing and enforcing stringent safety measures in construction projects.

Similarly, Zaini (2023) emphasizes the critical importance of safety precautions in the construction industry, particularly in light of the increasing number of fatalities and injuries. The author stressed the need for construction companies to implement safety, health, and environmental management systems to mitigate these risks. This aligns with the query's focus on the role of safety precautions in reducing workplace accidents.

Nnaji et al. (2020) studied the potential of wearable safety devices (WSDs) to mitigate accidents in construction sites, addressing the need for innovative safety measures amid stagnant fatality reduction. The study emphasized the importance of assessing both the direct impact of WSDs on safety performance and top management's perception of their efficacy by assessing the impact of wearable sensing devices as a control measure and how their features could have prevented fatalities using archival data and the opinions of top management.

Additionally, Yap et al. (2020) provide a comprehensive review of various techniques for safety and health management in the construction industry. The paper highlights the importance of these techniques in reducing workplace fatalities, accidents, and illnesses, particularly in emerging economies. The author identifies a range of technologies and materials as key elements in securing construction work sites and ensuring the well-being of the workforce. These techniques not only enhance the healthy environment in the work site, but also reduce risks, increase productivity, and improve the quality and delivery time of construction projects. The paper specifically discusses the role of coordinators and motivators, the use of a hybrid BN-HFACS model, VP-based safety system management, RFID technology with mobile applications, leading and lagging indicators, BIM technology, science mapping, and 4D CAD models in achieving these goals.

Alarcon, et al. (2016) assessed the safety management in construction sites. The study selected a sample of 1180 construction firms and 221 individuals in Chile using a random sampling technique. The data for the study was analysed using visual analysis of graphical information, statistical analyses and classification techniques. The result revealed that practices related to safety incentives and rewards are the most effective from the accident rate viewpoint. Again, practices related to accidents and incidents had a slight negative impact on the accident rate because they are frequently used as a reactive measure.

Brahmacharya, et al., (2018) investigated safety and quality management practices in construction sites in Dhaka, the capital city of Bangladesh. The study adopted a qualitative research method by critically reviewing relevant literature on the subject matter.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIII, Issue XII, December 2024

The study concluded that site workers often lost their lives in the construction sites as a result of different unwanted hazards like; falls from height due to failure of temporary structures like scaffolding and ladders, electrical shocks and improper crane operations. Furthermore, workers' illiteracy, lack of proper training regarding health and safety, consumption of alcohol and other substances at work, not using safety equipment, ignorance, carelessness and overconfidence.

Albarkani & Shafii (2021) examined the impact of construction safety and performance in the Malaysian construction industry by reviewing relevant literature. The study found that construction safety practices would improve the overall performance of the Malaysian construction industry. Hence, it was suggested that growing research and development, training and the availability of adequate construction materials are important to improve the Malaysian construction industry's safety and efficiency.

Muthuswamy & Sudhakar (2023) examined the influence of operational safety, health performance and safety preparation on the project performance of construction companies in Saudi Arabia using a quantitative analysis methodology. A sample size of 316 employees were engaged for the study and a well-designed questionnaire was adopted to collect pertinent data for the study and subsequently subjected to analysis using a structural equation model and confirmatory factor analysis. The findings of the study health and safety measured are significant factors that contribute to the enhanced performance of construction companies.

III. Research Methodology

This study adopts a quantitative method which involves the collection of data from participants from the field. The study population includes the director of physical planning, directors of Works, chief builder and site supervisors of the contracting firms in the tertiary institutions in the North-West region of Nigeria. 42 participants were selected for the study using a purposive sampling technique and a well-structured questionnaire of 5-point Likert scale of strongly agreed to strongly disagree designed to collect pertinent data for the study. Data collected for this study will be analysed using the Relative Important Index (RII).

Relative Important Index = $\frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{A * N}$

Where n_5 = Number of respondents for strongly agree
n_4 = Number of respondents for agree
n_3 = Number of respondents for neutral
n_2 = Number of respondents for disagree
n_1 = Number of respondents for strongly disagree

A=Highest Weight (5)
N = Total number of respondents (42)

However, this analysis will be carried out using the mean and standard deviation figure produced by SPSS.

Data Presentation and Analysis

This study evaluates the impact of sustainable safety practices on the reduction of accidents and fatalities in Construction Project Sites of Tertiary institutions in North-West, Nigerian. A sample size of forty-two was drawn across tertiary institutions in the north-west region of Nigeria. Subsequently, a well-structured questionnaire of 5-point Likert scale of 5-Strongly agree, 4-Agree, 3-Neutral, 4-Disagree and 1-Strongly disagreed were administered to the respondents to elicit responses that would answer the study's research questions. To achieve these objectives the Related Importance Index (RII) was adopted to reveals the impact of sustainable safety practices on the reduction of accidents and fatalities in construction sites in the north-west tertiary institutions. The key findings from the analysis of data are organised and summarised to aid the discussion of results.

Table 4.1: Effect of the Implementation of Safety Practices on Construction Project Sites in Tertiary Institutions in the North-West of Nigeria

	Response					
Item	**SA**	**A**	**N**	**D**	**SD**	**Total**
1. Reduce Accidents and Fatalities	23	13	3	2	1	42
2. promotes safer working conditions and practices, sustainable safety initiatives contribute to the overall health and well-being of construction workers	17	15	5	3	2	42
3. Enhanced Reputation and Stakeholders Trust	24	15	3	0	0	42
4. Save cost through fewer accidents and fines and penalties from non-adherence to safety regulations and standards	19	14	7	2	0	42
5. Contributes to environmental protection and sustainability efforts, aligning with broader goals of environmental	9	10	11	8	4	42

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIII, Issue XII, December 2024

stewardship and social responsibility.						
6. Increases social cohesion, economic growth, and opportunities for collaboration and partnerships with local stakeholders.	9	14	13	4	2	42

Source: Field Survey, 2024.

Table 4.2: Computation of Relative Importance Index (RII)

Statement	N	Mean (RII)	Std. Deviation	Rank
1. Reduce Accidents and Fatalities	42	4.31	.975	2
2. promotes safer working conditions and practices, sustainable safety initiatives contribute to the overall health and well-being of construction workers	42	4.00	1.126	4
3. Enhanced Reputation and Stakeholders Trust	42	4.50	.634	1
4. Save cost through fewer accidents and fines and penalties from non-adherence to safety regulations and standards	42	4.19	.890	3
5. Contributes to environmental protection and sustainability efforts, aligning with broader goals of environmental stewardship and social responsibility.	42	3.29	1.274	6
6. Increases social cohesion, economic growth, and opportunities for collaboration and partnerships with local stakeholders.	42	3.57	1.085	5

Source: Author's computation from SPSS output.

The analysis of the Relative Importance Index (RII) regarding the effect of implementing safety practices on construction project sites in tertiary institutions in North-West Nigeria reveals a comprehensive view of stakeholders' perceptions and priorities. At the forefront, enhancing reputation and stakeholders' trust emerges as the most significant outcome, with mean figure of 4.50, underscoring the critical importance of safety in building credibility and fostering trust among stakeholders. This highlights that organizations viewed as prioritizing safety are likely to benefit from enhanced reputations and stronger relationships with stakeholders. Following closely, the reduction of accidents and fatalities, with a mean statistic of 4.31, stands out as a pivotal outcome, emphasizing the direct impact of safety practices on protecting worker health and well-being. Moreover, the cost-saving potential through fewer accidents and penalties, with a mean statistic of 4.19, highlight the financial benefits of effective safety management, illustrating how investments in safety can yield substantial returns by reducing operational costs and regulatory liabilities. Promoting safer working conditions and practices, ranked fourth with 4.00 mean statistic, reinforces the importance of sustainable safety initiatives in creating a conducive and healthy work environment. Additionally, the recognition that safety practices contribute to social cohesion, economic growth, and collaboration opportunities, with a mean of 3.57, highlights the broader societal benefits of safety-conscious practices in fostering community engagement and development. Lastly, while contributing to environmental protection and sustainability efforts, ranked sixth with a mean figure of 3.29, stressed the alignment of safety practices with environmental goals, indicating an opportunity to enhance environmental stewardship through improved safety measures. In conclusion, the RII analysis using the mean statistics emphasizes that implementing robust safety practices not only safeguards workers and reduces costs but also enhances organizational reputation, fosters community ties, and aligns with broader sustainability objectives, making safety a cornerstone of successful construction projects in the region.

Table 4.3: Impact of Sustainable Safety Practices on Accidents and Fatalities in Construction Project Sites in the North-West institutions in Nigeria

	Response					
Item	**SA**	**A**	**N**	**D**	**SD**	**Total**
1. Safety practices effectively reduce the level of fatalities in construction project sites of tertiary institutions in North-West, Nigeria.	13	16	4	5	4	42
2. The implementation of safety protocols significantly contributes to the reduction of fatalities in construction projects at tertiary institutions in North-West Nigeria.	18	15	5	3	1	42
3. Workers' adherence to safety guidelines plays a crucial role in minimizing fatalities on construction sites within tertiary institutions in	16	18	4	3	1	42

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIII, Issue XII, December 2024

	North-West Nigeria.						
4.	The level of fatalities on construction project sites at tertiary institutions in North-West Nigeria decreases with the consistent enforcement of safety measures.	19	14	7	2	0	42
5.	There is a direct correlation between the improvement of safety practices and the reduction of fatalities in construction projects within tertiary institutions in North-West Nigeria.	18	15	5	2	2	42

Source: Field Survey, 2024.

Table 4.4: Computation of Relative Importance Index (RII)

Statement	N	Mean (RII)	Std. Deviation	Rank
1. Safety practices effectively reduce the level of fatalities in construction project sites of tertiary institutions in North-West, Nigeria.	42	3.69	1.297	5
2. The implementation of safety protocols significantly contributes to the reduction of fatalities in construction projects at tertiary institutions in North-West Nigeria.	42	4.10	1.031	2
3. Workers' adherence to safety guidelines plays a crucial role in minimizing fatalities on construction sites within tertiary institutions in North-West Nigeria.	42	4.07	.997	3.5
4. The level of fatalities on construction project sites at tertiary institutions in North-West Nigeria decreases with the consistent enforcement of safety measures.	42	4.19	.890	1
5. There is a direct correlation between the improvement of safety practices and the reduction of fatalities in construction projects within tertiary institutions in North-West Nigeria.	42	4.07	1.091	3.5

Source: Author's Computation from SPSS output

The analysis of the Relative Importance Index (RII) concerning the impact of sustainable safety practices on accidents and fatalities in construction project sites at tertiary institutions in North-West Nigeria reveals critical insights into the perceived effectiveness of safety measures. Topping the list is the consistent enforcement of safety measures, ranked first with a mean statistic of 4.19, revealing the pivotal role of maintaining strict adherence to safety protocols in reducing fatalities. This highlights the consensus on the necessity of not just implementing but also rigorously upholding safety standards throughout construction operations. Following closely, the implementation of safety protocols is rated second with a mean of 4.10, indicating strong confidence in structured safety procedures to mitigate risks effectively and enhance overall workplace safety. Similarly, workers' adherence to safety guidelines ranks third with a mean of 4.07, emphasizing the proactive role of workforce compliance in accident prevention and the importance of comprehensive safety training and supervision. Additionally, the perceived direct correlation between improving safety practices and reducing fatalities, also with a mean of 4.07, highlight the on-going need for continuous improvement in safety management systems to achieve measurable enhancements in accident prevention. Overall, these findings emphasized the critical importance of sustained efforts in safety management to safeguard workers, mitigate risks, and foster safer construction environments in North-West Nigeria's tertiary institutions.

IV. Discussion of Results

The analysis of the Relative Importance Index (RII) regarding the effect of implementing safety practices on construction project sites in tertiary institutions in North-West Nigeria reveals critical insights into stakeholders' perceptions and priorities. Enhancing reputation and stakeholders' trust emerges as the most significant outcome, highlighting the vital role of safety in building credibility and fostering trust among stakeholders. This finding aligns with Chen et al. (2015) and Lipinski et al. (2020), who highlight the positive correlation between robust safety management and enhanced organizational reputation. Organizations prioritizing safety are seen as reliable and trustworthy, benefiting from stronger relationships with stakeholders and improved public perception. The reduction of accidents and fatalities stands out as a pivotal outcome, emphasizing the direct impact of safety practices on worker health and well-being. This finding is supported by Gambatese, (2000); Azil & Jabar, (2021), who found that effective safety practices not only protect workers but also enhance project success by minimizing disruptions caused by accidents. Promoting safer working conditions and practices reinforces the importance of sustainable safety initiatives in creating a conducive and healthy work environment, aligning with the findings of Shamsuddin et al. (2022) and Ahmad et al.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIII, Issue XII, December 2024

(2018), who stress the significance of safety awareness and proper working conditions in construction projects. The cost-saving potential through fewer accidents and penalties stressed the financial benefits of effective safety management. Nagarajan & Ganapathi (2024) and Forbes & Ahmed (2010) support this, illustrating how investments in safety can yield substantial returns by reducing operational costs and regulatory liabilities. Integrating safety concerns into project management is crucial for achieving greater value, lower costs, and reduced risks, as highlighted by Forbes & Ahmed (2010). Additionally, the recognition that safety practices contribute to social cohesion, economic growth, and collaboration opportunities highlights the broader societal benefits of safety-conscious practices. This perspective is echoed by Azil and Jabar (2021), who emphasize that proper safety measures, such as barricading entrances and exits, not only protect the public but also foster community engagement and development. The alignment of safety practices with environmental goals further stresses the opportunity to enhance environmental stewardship through improved safety measures. Studies by Lombardi et al. (2023) and Kent & Razak (2012) highlight the importance of compliance with safety and health regulations in promoting both worker and environmental safety. In conclusion, the RII analysis emphasizes that implementing robust safety practices not only safeguards workers and reduces costs but also enhances organizational reputation, fosters community ties, and aligns with broader sustainability objectives. These findings are consistent with existing literature that highlights the multifaceted benefits of effective safety management in construction projects. The integration of safety into all aspects of project management is essential for achieving these outcomes, making safety a cornerstone of successful construction projects in the region.

Similarly, the analysis of sustainable safety practices' impact on accidents and fatalities in construction project sites at tertiary institutions in North-West Nigeria highlights several critical insights. Foremost, the rigorous enforcement of safety measures emerges as pivotal, highlighting its role in reducing fatalities by maintaining strict adherence to protocols throughout construction operations. This finding aligns with studies by Yusoff (2015) and Zaini (2016), emphasizing the necessity of stringent safety measures to prevent accidents and mitigate risks in construction settings. Additionally, the effective implementation of safety protocols and workers' adherence to safety guidelines are identified as crucial factors in accident prevention, echoing Yap's et al. (2020) discussion on various techniques for enhancing safety and health management in construction. These practices not only reduce workplace fatalities but also contribute to a safer and more productive environment, as highlighted by Nnaji et al. (2020) exploration of wearable safety devices' potential to enhance safety performance. Moreover, the study stressed the broader implications of safety management systems in enhancing project performance and overall industry efficiency, resonating with findings from studies such as Alarcon et al. (2016), Brahmachary et al. (2018), Albarkani and Shafii (2021), and Muthuswamy and Sudhakar (2023). Together, these insights emphasize the critical role of sustained efforts in safety management to safeguard workers, mitigate risks effectively, and foster safer construction environments in North-West Nigeria's tertiary institutions.

V. Conclusion

This study highlights the paramount importance of effective safety management in construction projects within tertiary institutions across North-West Nigeria. By prioritizing comprehensive safety practices, institutions can significantly mitigate risks, safeguard the well-being of their workers, enhance project efficiency, and bolster their overall reputation. The findings stressed the necessity for continuous improvement in safety standards, emphasizing proactive measures such as robust safety training and strict adherence to safety protocols. Again, integrating safety considerations into all phases of project management emerges as crucial for achieving sustainable safety outcomes. Hence, there is need for collaborative efforts among stakeholders, including educational institutions, regulatory bodies, and construction firms to implement and enforce comprehensive safety measures effectively. By doing so, these institutions can not only mitigate immediate risks but also contribute to broader societal goals of promoting workplace safety and well-being in the construction industry.

Reference

1. Abubakar, M. A., Zailani, B. M., Abdullahi, M., & Auwal, A. M. (2022). Potential of adopting a resilient safety culture toward improving the safety performance of construction organizations in Nigeria. Journal of engineering, design and technology, 20(5), 1236-1256.
2. Ahmad, N. I., Ab-Kadir, M. Z. A., Izadi, M., Azis, N., Radzi, M. A. M., Zaini, N. H., & Nasir, M. S. M. (2018). Lightning protection on photovoltaic systems: A review on current and recommended practices. Renewable and Sustainable Energy Reviews, 82, 1611-1619.
3. Ahmed, S. (2019). Causes and effects of accident at construction site: A study for the construction industry in Bangladesh. International journal of sustainable construction engineering and technology, 10(2), 18-40.
4. Aiyewunmi, T. (2023). Challenges and potential solutions to pluvial flood risk in urban tropical African communities, a case study using Ijebu-Ode, in South West Nigeria (Doctoral dissertation, University of Liverpool).
5. Ajmal, M., Isha, A. S. N., Nordin, S. M., & Al-Mekhlafi, A. B. A. (2022). Safety-management practices and the occurrence of occupational accidents: Assessing the mediating role of safety compliance. Sustainability, 14(8), 45-69.
6. Alarcón, L. F., Acuña, D., Diethelm, S., & Pellicer, E. (2016). Strategies for improving safety performance in construction firms. Accident Analysis & Prevention, 94, 107-118.
7. Albarkani, M. S. S., & Shafii, H. (2021). Construction Safety and Performance in Malaysian Construction Industry: A Review. Journal of Technology Management and Business, 8(2), 79-93.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIII, Issue XII, December 2024

8. Amirah, N. A., Him, N. F. N., Rashid, A., Rasheed, R., Zaliha, T. N., & Afthanorhan, A. (2024). Fostering a Safety Culture in Manufacturing Industry through Safety Behavior: A Structural Equation Modelling Approach. Journal of Safety and Sustainability.
9. Asanka WA, Ranasinghe M. (2015). Study on the impact of accidents on construction projects. In 6th International Conference on Structural Engineering and Construction Management, 58–67.
10. Aridi, A. S., Burrell, D. N., Finch, A., Burton, S. L., Quisenberry, W. L., Jones, L. A., ... & Mondala-Duncan, M. (2024). Coaching Cybersecurity Project Managers and Cyber-security Engineers. In Evolution of Cross-Sector Cyber Intelligent Markets (pp. 356-377). IGI Global
11. Azil, N. A. S., & Jabar, I. L. (2021). A Preliminary Survey nn Safety Practices At Construction Site: Towards Safe Environment For Public. Journal of Tourism Hospitality and Environment Management, 6 (26), 300-310.
12. Bathan, J., & Joy, C. A. (2023). Modelling the mediating effects of occupational safety and health management between organization culture and business performance among employees of construction companies. International Journal of Open-Access, Interdisciplinary & New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR), 2(4), 131-156.
13. Brahmachary, T. K., Ahmed, S., & Mia, M. S. (2018). Health, safety and quality management practices in construction sector: A case study. Journal of System and Management Sciences, 8(2), 47-64.
14. Burns, M. G. (2019). Managing energy security: an all hazards approach to critical infrastructure. Routledge.
15. Chan, A. P. C., Yang, Y., & Darko, A. (2018). Construction accidents in a large-scale public infrastructure project: Severity and prevention. Journal of Construction Engineering and Management, 144(10), 05018010.
16. Chen, S. Y., Wu, W. C., Chang, C. S., Lin, C. T., Kung, J. Y., Weng, H. C., ... & Lee, S. I. (2015). Organizational justice, trust, and identification and their effects on organizational commitment in hospital nursing staff. BMC health services research, 15, 1-17.
17. Echavaria, F., & Espiritu, J. Q. (2024). Firefighting Capabilities and Performance of the Bureau of Fire Protection-Marinduque in Responding to Fire Incidence: Basis for Service Delivery Framework. Psychology and Education: A Multidisciplinary Journal, 18(1), 41-68.
18. Famakin, I. O., Aigbavboa, C., & Molusiwa, R. (2023). Exploring challenges to implementing health and safety regulations in a developing economy. International Journal of Construction Management, 23(1), 89-97.
19. Forbes, L. H., & Ahmed, S. M. (2010). Modern construction: lean project delivery and integrated practices. CRC press.
20. Fowler, D., & Tiemeyer, B. (2006). Safety Case Development-a Practical Guide. In Developments in Risk-based Approaches to Safety: Proceedings of the Fourteenth Safety-critical Systems Symposium, Bristol, UK, 7–9 February 2006 (pp. 105-137). Springer London.
21. Fu, G., Xie, X., Jia, Q., Li, Z., Chen, P., & Ge, Y. (2020). The development history of accident causation models in the past 100 years: 24Model, a more modern accident causation model. Process Safety and Environmental Protection, 134, 47-82.
22. Gambatese, J. A. (2000). Owner involvement in construction site safety. In Construction Congress VI: Building Together for a Better Tomorrow in an Increasingly Complex World (pp. 661-670).
23. Garba, U., Ibrahim, D., & Karem, W. B. (2022). Utilization of Safety Facilities in Building Construction Sites in Federal Capital Territory Abuja and Niger State, Nigeria. Journal of Sustainability and Environmental Management, 1(2), 144-150.
24. Giri, O. P. (2023). An Overview of Safety and Health Management Challenges in The Construction Industry. Available at: http://10.5281/zenodo.8251525 (Accessed: 23 September 2024).
25. Grzebieta, R. H. (2015). Welcome to Safety—A New Open Access Journal Helping Shape a Safer World. Safety, 1(1), 1-6
26. Hamid, A. R. A., Abd Majid, M. Z., & Singh, B. (2008). Causes of accidents at construction sites. Malaysian journal of civil engineering, 20(2).
27. Ind, N. (2007). Living the brand: How to transform every member of your organization into a brand champion. Kogan Page Publishers
28. Keng, T. C., & Razak, N. A. (2014). Case studies on the safety management at construction site, Journal of Sustainability Science and Management, 9(2), 90-108.
29. Lipinski, T., Ahmad, D., Serey, N., & Jouhara, H. (2020). Review of ventilation strategies to reduce the risk of disease transmission in high occupancy buildings. International Journal of Thermo fluids, 7, 100045.
30. Lombardi, M., Mauro, F., Berardi, D., & Galuppi, M. (2023). Occupational road safety management: a preliminary insight for a landfill remediation site. Buildings, 13(5), 1238
31. Lizák, L., & Etemova, E. (2023). The Socio-Economic Determinants of Crime in Sweden, 2015-2020.
32. Manuele, F. A. (2003). On the practice of safety. John Wiley & Sons.
33. Marchiori, R., Song, S., Ajasa, S., & Lyu, P. (2024) Assessing Usability, Frequency, and Efficiency of Fall Hazard Prevention Devices in Construction: Development of a Comprehensive Questionnaire for Evaluation. In Construction Research Congress 2024 (pp. 518-527).
34. Martin, H., Mohan, N., Ellis, L., & Dunne, S. (2021). Exploring the role of PPE knowledge, attitude, and correct practices in safety outcomes on construction sites. Journal of Architectural Engineering, 27(4), 05021011

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIII, Issue XII, December 2024

35. Muthuswamy, V. V., & Sudhakar, B. (2023). Project Performance: Role of Operational Safety, Health Performance and Safety Preparation. Operational Research in Engineering Sciences: Theory and Applications, 6(1).
36. Nagarajan, M., & Ganapathi, R. (2024). Factor's determining successful risk management in construction projects. International Journal of Process Management and Benchmarking, 16(4), 512-532.
37. Ni, G., Zhang, Q., Fang, Y., Zhang, Z., Qiao, Y., Wang, W., & Deng, Y. (2023). How resilient safety culture correct unsafe behaviour of new generation of construction workers: The mediating effects of job crafting and perceived work meaningfulness. Engineering, Construction and Architectural Management, 30(10), 4821-4845.
38. Nnaji, C., Okpala, I., & Awolusi, I. (2020). Wearable sensing devices: Potential impact & current use for incident prevention. Professional safety, 65(04), 16-24.
39. Oni, O., Olanrewaju, A., & Cheen, K. S. (2022). Accidents at Construction Sites and Near-Misses: A Constant Problem. Proceedings of International Structural Engineering and Construction, 9, 2
40. Robla-Gómez, S., Becerra, V. M., Llata, J. R., Gonzalez-Sarabia, E., Torre-Ferrero, C., & Perez-Oria, J. (2017). Working together: A review on safe human-robot collaboration in industrial environments. Ieee Access, 5, 26754-26773.
41. Rostamnezhad, M., & Thaheem, M. J. (2022). Social Sustainability in Construction Projects—A Systematic Review of Assessment Indicators and Taxonomy. Sustainability, 14(9), 5279
42. Samsudin, N. S., Mohammad, M. Z., Khalil, N., Nadzri, N. D., & Ibrahim, C. K. I. C. (2022). A thematic review on Prevention through design (PtD) concept application in the construction industry of developing countries. Safety science, 148, 105640.
43. Singh, A., & Misra, S. C. (2021). Safety performance & evaluation framework in Indian construction industry. Safety science, 134, 105023.
44. Sulong, A. W., Hassan, A., Mohamed, T. & Raja, A. (2019). Guidelines on Safe Work Practice when Commuting in Oil Palm Plantations (2), 222–228.
45. Shi, W., & Xie, Y. (2024). From knowledge to success: understanding the crucial role of governance, tacit knowledge sharing, and team leadership in project outcomes. Current Psychology, 43(9), 8219-8229
46. Vincoli, J. W. (2024). Basic guide to system safety. John Wiley & Sons
47. Xu, J., Cheung, C., Manu, P., & Ejohwomu, O. (2021). Safety leading indicators in construction: A systematic review. Safety science, 139, 105250.
48. Yap, J. B. H., Skitmore, M., Lam, C. G. Y., Lee, W. P., & Lew, Y. L. (2024). Advanced technologies for enhanced construction safety management: investigating Malaysian perspectives. International Journal of Construction Management, 24(6), 633-642.
49. Yar Adua, I. S. (2022). The Effects of Security Threats on the Operations of Construction Sites in Northern Nigeria: A Case Study of Katsina State, Journal of Multidisciplinary Engineering Science Studies (JMESS), 8(4), 4484-4489.
50. Yusoff, S., Nordin, R., & Yusoff, H. (2015). Environmental Management Systems (EMS) ISO 14001 implementation in construction industry: A Malaysian case study. Issues in Social & Environmental Accounting, 9(1)
51. Zaini, N. Z. M., Hasmori, M. F., Moayedi, F., Abas, N. H., & Klufallah, M. (2023, October). Causes of the tower crane accident and safety performance practices at construction site in Malaysia: A perspectives from the tower crane operator. In AIP Conference Proceedings (Vol. 2881, No. 1). AIP Publishing.