

Construction Site Safety Management and Accident Prevention: An Analysis of Safety Practices and their Impact on Accident Reduction in Construction Projects

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Abstract: *The construction industry is one of the most hazardous industries because of its high rate of occupational accidents. Construction activities include complex trade operations, heavy machinery, elevated work environments, and multiple stakeholders, all of which increase the likelihood of workplace accidents. Ensuring worker safety, improving productivity, and reducing project delays are all essential to effective safety management practices. Safety training, personal protective equipment (PPE) compliance, site supervision, and safety audits were examined in this study. The purpose of the study is to determine how these practices affect site safety. A review of existing literature was conducted to identify the importance of safety management measures. The study uses a quantitative research approach to collect information from construction professionals. The identified safety factors were ranked according to their relative importance. The findings are expected to show that safety training, strict PPE compliance, effective site supervision, and regular safety audits greatly contribute to reducing construction site accidents. Practical measures that strengthen safety culture and reduce accidents are highlighted in the study. The study's recommendations can be used to improve safety management practices and enhance overall construction site performance.*

Keywords: Construction Safety, Accident Prevention, Safety Training, PPE Compliance, Site Supervision, Safety Audits, Safety Management.

1. Introduction

1.1 Background of the study

The construction industry is important for the development of both developed and developing countries. Employment generation, urban development, transportation networks, industrial facilities, and public infrastructure are all supported by construction projects. The construction industry is one of the most dangerous industries because of the high number of accidents [1]. Construction activities include working at heights, excavation work, operation of heavy machinery, electrical installations, material handling, and exposure to hazardous substances. Accidents can occur if safety measures are not implemented. Construction workers face a higher risk of injury compared to workers in other industries because of the complex nature of construction sites [2].

Occupational accidents in construction projects can cause severe consequences for workers, contractors, project owners, and society as a whole. Loss of life, physical injuries, psychological trauma, project delays, increased project costs, legal liabilities, compensation claims, and reduced productivity are some of the consequences [3]. As construction projects become more complex, the need for effective safety management systems becomes more important. Safety management involves the systematic planning, implementation, monitoring, and improvement of safety measures to prevent accidents. Safety management requires commitment from all stakeholders. Strong safety management practices have been shown to lower accident rates [4].

Several factors influence construction site safety. Safety training, personal protective equipment (PPE) compliance, site supervision, and safety audits are some of the critical components of an effective safety management strategy. Safety training can help workers recognize hazards and follow safe work practices. Well-trained workers are more likely to work safely [5]. The final line of defense against workplace hazards is PPE. Helmets, gloves, safety shoes, goggles, reflective vests, and fall protection equipment help reduce the severity of injuries when accidents occur. The effectiveness of PPE depends on proper use and compliance by workers [6].

Site supervision is another important aspect of construction safety management. Supervisors ensure compliance with established safety procedures. Effective supervision helps prevent accidents by identifying unsafe conditions and practices [7]. Safety audits evaluate the effectiveness of safety management systems. Auditors help identify deficiencies, assess compliance with safety standards, and recommend corrective measures. Safety audits can help develop a strong safety culture [8]. Despite progress in construction technology, accidents remain a major concern. Poor supervision, inadequate training, and lack of PPE compliance are some of the factors that contribute to workplace accidents. Key safety management practices need to be investigated. This study examines the impact of safety training, PPE compliance, site supervision, and safety audits on accident prevention in construction projects. The study aims to understand how effective safety management practices can improve workplace safety and contribute to successful project outcomes.

1.2 Problem Statement

The construction industry has a high rate of occupational accidents despite the implementation of various safety regulations. Unsafe working conditions, inadequate safety awareness, insufficient training, poor supervision, and non-compliance with safety procedures are some of the challenges that continue to contribute to construction site accidents. These accidents lead to project delays, increased construction costs, and reduced productivity.

Many construction projects fail to implement effective safety management systems, which leads to unsafe work practices and increased accident risks. Although previous studies have shown the importance of safety management, there is a need to examine the influence of safety training, PPE compliance, site supervision, and safety audits. Understanding the effectiveness of these practices can help develop strategies that improve safety performance and reduce workplace accidents in construction projects.

1.3 Aim of the Study

Construction activities are inherently hazardous because of heavy equipment, elevated working platforms, and electrical systems. Despite the existence of safety regulations, construction accidents continue to occur at an alarming rate. Ensuring successful project execution depends on effective safety management practices.

This study will analyze construction site safety management practices and evaluate their impact on accident prevention in construction projects. Safety training, personal protective equipment compliance, site supervision, and safety audits are critical safety management variables. The purpose of the study is to determine the effectiveness of these factors in improving safety performance. The findings are expected to provide recommendations for enhancing construction site safety and promoting a safer working environment.

1.4 Objectives of the Study

The main objective of the study is to analyze construction site safety management practices and evaluate their impact on accident prevention in construction projects. The specific objectives are:

- 1) To examine the impact of safety training on accident prevention.
- 2) To evaluate the influence of PPE compliance on accident prevention.
- 3) To assess the role of site supervision in preventing accidents on construction sites.
- 4) To determine the impact of safety audits on construction site safety.
- 5) To identify the most significant safety management practice affecting accident prevention.

1.5 Research Questions

There are gaps in safety management practices. To create effective safety programs, it is necessary to understand the relationship between safety measures and accident

prevention. The following research questions have been formulated to achieve the objectives of the study.

- 1) How does safety training affect accident prevention in construction projects?
- 2) What is the relationship between PPE compliance and safety performance?
- 3) How does site supervision affect construction site safety?
- 4) What is the role of safety audits in accident prevention?
- 5) Which safety management practice has the greatest influence on accident prevention?
- 6) How can construction organizations improve their safety management systems?

The answers to these research questions will provide valuable insights into the effectiveness of construction safety management practices.

1.6 Research Hypotheses

The study proposes hypotheses regarding the relationship between the independent and dependent variables. The independent variables include safety training, PPE compliance, site supervision, and safety audits, while accident prevention is the dependent variable. Based on the objectives of the study, the following hypotheses are formulated:

H1: Safety training has a significant positive impact on accident prevention.

H2: PPE compliance has a significant impact on accident prevention.

H3: Effective site supervision has a significant impact on accident prevention.

H4: Regular safety audits significantly contribute to accident prevention.

These hypotheses will help determine the influence of selected safety management practices on accident prevention in construction projects.

2. Literature Review

2.1 Construction Site Safety Management

Construction site safety management is a systematic process of planning, organizing, implementing, and monitoring safety measures to prevent workplace accidents and ensure the well-being of construction workers. Safety management is an essential component of project success in the construction industry, which is characterized by dynamic work environments, complex trade operations, and exposure to various hazards. Hazard identification, risk assessment, implementation of preventive measures, worker participation, and continuous improvement of safety performance are some of the areas on which effective safety management systems focus.

According to Kines et al., strong safety communication systems and worker involvement in safety programs can lower accident rates [9]. Safety management contributes to higher productivity, reduced project delays, and lower financial losses resulting from accidents. Unsafe acts, unsafe conditions, inadequate training, and management failures can cause construction accidents. Safety management should be

integrated into all phases of project execution. A comprehensive safety management strategy promotes a proactive approach to accident prevention.

2.2 Safety Training and Accident Prevention

Construction site accidents can be prevented through safety training. Workers are educated about safety precautions, hazard recognition, and emergency procedures. Proper training can help workers identify hazards and respond appropriately. Poor safety performance in construction projects is often caused by inadequate training [10]. Workers who lack safety knowledge are more likely to engage in unsafe practices. Well-trained workers are more likely to comply with safety procedures.

Safety training programs include induction training for new employees, toolbox meetings, equipment operation training, emergency preparedness drills, and periodic safety awareness programs. These programs help ensure that workers remain aware of changing site conditions. Studies show that investment in continuous safety training leads to significant reductions in accidents [11]. A positive safety culture can also be developed through training. Workers are more likely to adopt safe work practices and participate in accident prevention initiatives when they receive adequate guidance from management.

2.3 Personal Protective Equipment Compliance

Personal Protective Equipment (PPE) is an essential safeguard against workplace hazards that cannot be completely eliminated through engineering or administrative controls. PPE includes safety helmets, safety shoes, gloves, protective eyewear, reflective clothing, respiratory protection, and fall arrest systems. The purpose of PPE is to minimize worker exposure to hazards. Proper use and worker compliance are the most important factors in PPE effectiveness. Adequate use of protective equipment contributes significantly to reducing construction-related injuries [12]. However, many workers fail to wear PPE due to various reasons.

Compliance with PPE requirements can reduce the severity of injuries. Organizations with weak compliance systems tend to experience higher accident frequencies. Effective PPE programs require regular training, monitoring, and enforcement. A strong safety culture can help improve PPE compliance. Workers are more likely to use protective equipment when management demonstrates commitment to safety. Therefore, PPE compliance remains an important aspect of construction projects.

2.4 Site Supervision and Safety Performance

Site supervision plays a vital role in monitoring site activities, enforcing safety regulations, and ensuring compliance with safety policies. Effective supervision helps identify hazards at an early stage and prevents unsafe behaviors that could lead to accidents. Molenaar et al. reported that better safety outcomes can be achieved in projects with strong supervision [13]. Regular inspections, safety briefings, corrective actions, and enforcement of

safety procedures are some of the methods supervisors use to influence worker behavior. Workers are encouraged to follow safety standards while working on site.

Poor supervision has been linked to many construction accidents. Failure to monitor workers and enforce safety procedures can increase exposure to hazards. Effective supervision ensures that workers receive proper guidance, equipment is used safely, and hazardous conditions are promptly addressed. The competence and experience of supervisors are equally important. Technical knowledge and safety awareness help supervisors make better decisions regarding site safety. Construction organizations should invest in stronger site monitoring mechanisms.

2.5 Safety Audits and Safety Improvement

Safety audits are used to assess compliance with safety requirements and evaluate the effectiveness of safety management systems. Albert et al. reported that safety audits help identify unsafe conditions before accidents occur [14]. Management can use audit findings to understand compliance levels, identify safety deficiencies, and implement corrective actions to improve workplace safety. Safety audits also promote accountability by ensuring that safety requirements are consistently monitored and enforced.

Safety audits may be conducted by internal auditors, independent auditors, or regulatory agencies. Regardless of the approach used, the primary objective remains the same: to identify potential hazards and improve safety performance. During audits, organizations are encouraged to review and improve their safety policies and procedures. According to research, projects with structured safety audit programs tend to have lower accident rates [15]. Audits help identify weaknesses in safety management systems and support accident prevention efforts.

2.6 Review of Previous Studies

The importance of safety management practices in reducing construction site accidents has been highlighted by several researchers. Kines et al. found that worker participation and safety communication can improve safety performance [9]. Jannadi and Assaf reported that safety training reduces unsafe acts and improves safety awareness [10]. Aksorn and Hadikusumo concluded that PPE compliance is a critical component of construction safety and that organizations with stronger PPE enforcement mechanisms experience fewer workplace injuries [12]. Similarly, Molenaar et al. found that improved safety outcomes are associated with active supervision and management commitment [13].

Albert et al. emphasized the importance of safety audits in identifying risks and improving safety systems [14]. Their findings indicate that regular safety assessments strengthen safety management systems. Guo et al. reported that the integration of training, supervision, PPE compliance, and safety audits into a comprehensive safety management framework significantly enhances accident prevention efforts [15].

Table 1: Summary of Previous Studies on Construction Safety Management

Author	Year	Major Findings
Kines et al.	2010	Safety communication improves safety performance
Jannadi & Assaf	1998	Safety training reduces unsafe practices
Aksorn & Hadikusumo	2008	PPE compliance improves worker safety
Molenaar et al.	2009	Effective supervision improves safety outcomes

2.7 Research Gap

Safety training, PPE compliance, site supervision, and safety audits are among the factors that influence construction site safety. Although several studies have examined these factors individually, limited research has investigated their combined impact on accident prevention. There is insufficient evidence regarding the relative importance of these safety management practices when considered together.

The purpose of this study is to examine the influence of safety training, PPE compliance, site supervision, and safety audits on accident prevention in construction projects. The study aims to provide a comprehensive understanding of construction site safety management and identify the practices that contribute most effectively to accident prevention.

3. Research Methodology

3.1 Research Methodology

The research methodology provides the framework through which the objectives of the study are achieved. It includes data collection, sample selection, analysis, and interpretation procedures. Ensuring the reliability and validity of research findings depends on selecting an appropriate methodology. The present study focuses on evaluating the impact of safety training, PPE compliance, site supervision, and safety audits on accident prevention in construction projects.

Quantitative research allows for the collection of measurable information from respondents and facilitates statistical analysis of relationships between variables in construction management studies. Quantitative methods have been widely used to evaluate safety management practices [16]. The present study uses a descriptive survey approach to gather information from construction professionals regarding safety practices implemented on construction sites and their influence on accident prevention. It is assumed that effective implementation of safety management practices contributes to accident prevention. Safety training, PPE compliance, site supervision, and safety audits are the independent variables.



Figure 1: Conceptual Framework

There is a relationship between safety management practices and accident prevention. Improvements in safety practices help reduce workplace accidents.

3.2 Data Collection and Sampling Procedure

The study utilizes both primary and secondary sources of data. Primary information was collected using a structured questionnaire. The questionnaire was developed using factors identified from the literature review and previous studies. Secondary information was obtained from books, journal articles, conference proceedings, industry reports, and safety guidelines published before September 2018. Construction project execution and safety management professionals were the target population. Project managers, site engineers, construction supervisors, contractors, and safety officers were included. They were considered appropriate because of their experience and involvement in construction safety management.

A convenience sampling technique was adopted for selecting respondents. Professionals with knowledge of safety practices were accessed through this sampling method. A total of 100 respondents were selected from various construction projects. The questionnaire was divided into two sections. The first section collected demographic information. Safety training, PPE compliance, site supervision, safety audits, and accident prevention were examined in the second section. The responses were recorded using a five-point Likert scale. The use of a Likert scale allows respondents to express their opinions regarding the effectiveness of safety management practices.

Table 2: Five-Point Likert Scale Used in the Study

Scale	Response
5	Strongly Agree
4	Agree
3	Neutral
2	Disagree
1	Strongly Disagree

The main reason for selecting the questionnaire approach was the cost-effective and efficient method of collecting information from a large number of respondents.

3.3 Data Analysis Technique

The collected data were analyzed using descriptive statistical methods. Various safety management practices were

evaluated using different analytical techniques. Descriptive statistics provide a clear picture of respondents' perceptions and opinions. The relative importance of each safety component was determined using the Relative Importance Index (RII) method. The RII technique is widely used in construction management research for ranking factors according to their importance and has been applied in studies involving safety performance, project delays, and risk assessment [17]. The Relative Importance Index was calculated using the following equation:

$$RII = (\sum W)/(A \times N)$$

Where:

- **RII** = Relative Importance Index
- **W** = Weight assigned by respondents (1-5)
- **A** = Highest possible weight (5)
- **N** = Total number of respondents

The RII value ranges from 0 to 1. The higher the value, the more important the component.

Table 3: Interpretation of Relative Importance Index

RII Value	Interpretation
0.80 - 1.00	Very High Importance
0.60 - 0.79	High Importance
0.40 - 0.59	Moderate Importance
0.20 - 0.39	Low Importance

The ranking of safety factors helps identify the most influential practices that contribute to accident prevention on construction sites.

3.4 Reliability, Validity and Research Flow

The reliability of the study was improved through the development of a structured questionnaire. All respondents were assessed using the same measurement scale. Validity was maintained by ensuring that the questionnaire adequately represented the variables included in the conceptual framework and aligned with the objectives of the study. The process began with the identification of the research problem and the review of relevant literature. Previous studies helped identify key safety management variables. Data were collected from construction professionals and analyzed using the Relative Importance Index technique. The impact of safety management practices on accident prevention was determined from the findings obtained through the collected responses.

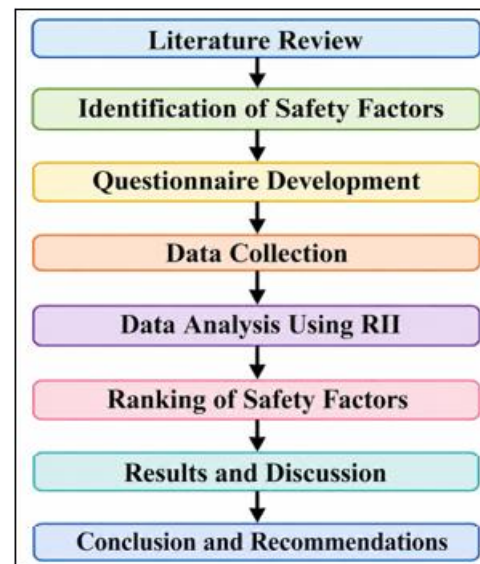


Figure 2: Research Flow Diagram

A structured approach for evaluating the effectiveness of safety training, PPE compliance, site supervision, and safety audits in reducing construction site accidents was adopted in this study.

4. Results and Discussion

4.1 Results and Discussion

The information collected from construction professionals regarding safety training, PPE compliance, site supervision, and safety audits is presented in this chapter. The influence of each safety management practice on accident prevention in construction projects was determined using the collected responses. A total of 100 questionnaires were distributed to project managers, site engineers, supervisors, contractors, and safety officers. The responses were ranked according to their importance in improving construction site safety.

Table 4: Distribution of Respondents by Designation

Designation	Frequency	Percentage (%)
Project Managers	15	15
Site Engineers	30	30
Site Supervisors	25	25
Safety Officers	20	20
Contractors	10	10
Total	100	100

According to the distribution, 30% of the respondents were site engineers. This was followed by site supervisors, safety officers, project managers, and contractors. Opinions were collected from professionals involved in construction site safety management.

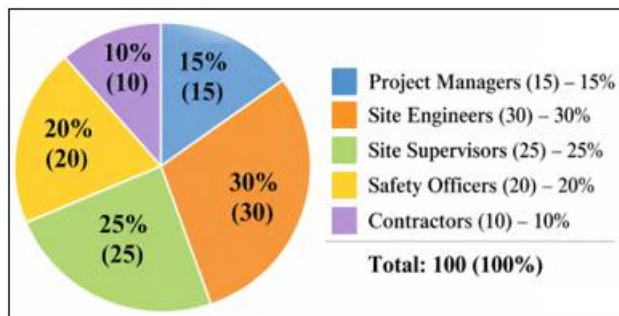


Figure 4: Distribution of Respondents by Designation

The diversity of professional categories improves the reliability of the findings because safety management practices affect all levels of construction project execution. The respondents were asked to rate various safety training practices. Safety training factors included safety awareness sessions, emergency preparedness training, and refresher training programs.

Table 5: Assessment of Safety Training

Safety Training Factor	Mean Score	RII
Safety induction programs	4.42	0.884
Toolbox meetings	4.3	0.86
Emergency response training	4.35	0.87
Refresher training programs	4.28	0.856
Hazard awareness training	4.48	0.896

Hazard awareness training was identified as the most effective component of safety training. The high RII value demonstrates the importance of familiarizing workers with safety procedures and workplace hazards. These findings support the observations of Fang et al., who reported that worker behavior is improved through safety awareness and training [16]. The effectiveness of PPE compliance was also evaluated. PPE compliance includes the proper use of safety helmets, gloves, safety shoes, goggles, reflective jackets, and fall protection equipment.

Table 6: Assessment of PPE Compliance

PPE Compliance Factor	Mean Score	RII
Use of safety helmets	4.15	0.830
Use of safety shoes	4.10	0.820
Use of reflective jackets	4.05	0.810
Use of safety harnesses	4.22	0.844
Use of eye protection	4.08	0.816

The highest RII value was obtained for the use of safety harnesses. Proper use of protective equipment contributes significantly to worker safety. The work of Aksorn and Hadikusumo concluded that strict PPE compliance significantly reduces the severity of construction-related injuries [12]. Site supervision was another important factor examined in the study. Respondents evaluated the role of supervisors in maintaining site safety.

Table 7: Assessment of Site Supervision

PPE Compliance Factor	Mean Score	RII
Monitoring worker activities	4.35	0.870
Enforcement of safety rules	4.38	0.876
Hazard identification	4.40	0.880
Safety communication	4.32	0.864
Corrective action implementation	4.36	0.872

The highest RII value was achieved by hazard identification, demonstrating the importance of proactive supervision. Effective supervision ensures that hazards are identified and addressed before injuries or property damage occur. The findings support the conclusions of Molenaar et al., who stated that management commitment is associated with improved safety performance [13]. The effectiveness of safety audits was also investigated. Compliance with safety standards is evaluated through safety audits.

Table 8: Assessment of Safety Audits

Safety Audit Factor	Mean Score	RII
Site safety inspections	4.18	0.836
Compliance monitoring	4.20	0.840
Identification of unsafe conditions	4.28	0.856
Corrective action tracking	4.16	0.832
Continuous safety improvement	4.24	0.848

The highest RII value was obtained for the identification of unsafe conditions. Regular audits are important for detecting hazards and improving safety performance. Management can use safety audits to gain a better understanding of their safety management systems. These findings align with the observations of Albert et al., who reported that audits promote continuous safety improvement and accident prevention [14]. The relative importance of the major variables was determined using the average RII value.

Table 9: Ranking of Safety Management Factors

Safety Factor	Mean Score	RII
Safety Training	0.873	1
Site Supervision	0.872	2
Safety Audits	0.842	3
PPE Compliance	0.824	4



Figure 5: Ranking of Safety Factors Based on RII

Safety training was identified as the most important factor affecting accident prevention. Site supervision, safety audits, and PPE compliance also demonstrated strong contributions to construction site safety performance. The high RII values indicate that accident prevention requires a combination of multiple safety management practices. The findings of previous studies are consistent with the results of this research. Effective safety management involves training, supervision, inspections, and worker participation [17]. The results show that construction organizations can reduce accident occurrences by investing in safety training programs, strengthening site supervision, promoting PPE compliance, and conducting regular safety audits. These

practices contribute to a stronger safety culture and improved project performance.

5. Conclusion and Recommendations

5.1 Conclusion

The use of heavy equipment, changing work environments, and multiple stakeholders makes the construction industry one of the most hazardous industries. Construction site accidents can affect the health and safety of workers and result in project delays, increased costs, productivity losses, legal liabilities, and reputational damage to construction organizations. Successful construction project execution requires effective safety management. The primary objective of this study was to analyze the impact of safety training, PPE compliance, site supervision, and safety audits on accident prevention in construction projects. A review of existing literature was conducted to understand the role of safety management practices. The importance of each safety component was evaluated using a survey.

The study found that all four safety management practices contribute to accident prevention. Safety training was identified as the most significant factor, suggesting that educating workers about workplace hazards, safety procedures, and emergency response measures plays a critical role in preventing accidents. Workers who receive adequate safety training are more likely to follow safety procedures. The second most important factor was site supervision. Effective supervision ensures that safety regulations are implemented consistently and that unsafe conditions are identified and corrected before accidents occur. Supervisors play a vital role in ensuring compliance with safety policies.

The positive impact of safety audits on accident prevention was also identified. Regular evaluations provide opportunities for continuous improvement. Safety audits ensure that hazards are addressed before they cause injuries or property damage. PPE compliance was also found to have a positive influence on construction site safety. Personal protective equipment helps reduce worker exposure to hazards. The effectiveness of PPE depends on worker compliance and management enforcement. A single safety measure alone cannot prevent accidents in construction projects. Effective safety performance requires safety training, PPE compliance, site supervision, and safety audits working together. If construction organizations invest in these practices, they are more likely to create safer working environments, reduce accident rates, and improve overall project performance.

5.2 Major Findings

The analysis conducted in this study identified the following major findings:

- 1) Safety training was the most important safety management practice with an RII value of 0.873, demonstrating its significant contribution to accident prevention.

- 2) Site supervision received the second-highest ranking, highlighting the importance of active monitoring and enforcement of safety regulations.
- 3) Safety audits recorded an RII value of 0.842, demonstrating their effectiveness in identifying hazards and improving safety performance.
- 4) PPE compliance confirmed the importance of protecting workers from workplace hazards.
- 5) All four safety management practices had a positive influence on construction safety performance.
- 6) A comprehensive safety management approach is more effective than individual safety measures alone.
- 7) Improved safety management practices contribute to improved productivity and project performance.

5.3 Recommendations

The following recommendations are proposed to improve construction site safety management.

1) *Safety Training*

Construction organizations should provide regular safety training for workers. Training programs should address emerging hazards and changing construction practices. Continuous safety education should be encouraged to improve worker awareness and safety performance.

2) *Strengthening Site Supervision*

Construction projects should have qualified and experienced supervisors. Supervisors should conduct regular inspections, monitor worker activities, and enforce safety regulations. Effective communication between workers and supervisors should be encouraged.

3) *Improving PPE Compliance*

Employers should provide appropriate personal protective equipment to all workers. Strict enforcement policies should be implemented to address non-compliance. Protective equipment should be inspected regularly to ensure proper condition and effectiveness.

4) *Conducting Regular Safety Audits*

Construction companies should conduct regular safety audits to ensure compliance with safety standards. Audit findings should be documented properly, and corrective actions should be implemented promptly to address identified deficiencies.

5) *Promoting Safety Culture*

Management should actively support safety initiatives and encourage worker participation in safety programs. A positive safety culture can improve attitudes toward safety and promote safer work practices.

6) *Continuous Improvement*

Changes in regulatory requirements and industry best practices should be incorporated into safety management systems. Continuous improvement is necessary for maintaining effective safety performance and reducing workplace accidents.

5.4 Limitations of the Study

A limited number of respondents were included in the study. Therefore, the findings may not fully represent the entire construction industry. Safety training, PPE compliance, site supervision, and safety audits were the only safety management variables examined in this study. Other important factors such as safety culture, organizational commitment, worker motivation, financial resources, and regulatory enforcement were not included in the analysis. The findings are based on the perceptions and experiences of respondents. Future studies may include larger sample sizes and broader geographical coverage to improve the generalizability of the results.

5.5 Future Scope of Research

Future research may examine additional factors that affect construction site safety, such as safety culture, leadership commitment, worker behavior, and technological innovations. Modern technologies such as Building Information Modeling (BIM), wearable safety devices, artificial intelligence, and real-time monitoring systems for accident prevention may also be explored. Comparative studies involving different types of construction projects, geographical locations, and organizational structures can provide further insights into effective safety management strategies. Future researchers may also use advanced statistical methods to examine the relationships between safety management variables and project performance indicators.

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