

Accident Investigation and Reporting Practices in the Construction Industry: Enhancing Safety and Organizational Learning

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Publication Date: 2025/09/29

Abstract: With a high rate of workplace accidents, injuries, and fatalities, the construction industry continues to rank among the most dangerous in the world. Effective accident investigation and reporting are essential for enhancing safety management systems, preventing recurrence, and promoting organizational learning in addition to regulatory framework compliance (Lingard et al. 2017, Swuste et al. in 2020). With a focus on their function in risk reduction and a long-lasting safety culture, this paper examines the fundamentals, procedures, and difficulties of accident investigation and reporting in the construction industry. There are suggestions for improving reporting systems in developing contexts, along with case studies and best practices.

Keywords: Accident Investigation, Reporting, Construction Safety, Organizational Learning, Occupational Health.

How to Cite: Dowell David Ikpokini; Ahmed Tijani Ashiru; Aliyu Umar Mohammed; Paul Ayanda; Rahinatu Ibrahim; Aliyu Zubairu; Olumide Israel Oyekeye; Halimat Omaye Abubakar (2025) Accident Investigation and Reporting Practices in the Construction Industry: Enhancing Safety and Organizational Learning. *International Journal of Innovative Science and Research Technology*, 10(9), 1888-1893. <https://doi.org/10.38124/ijisrt/25sep818>

I. INTRODUCTION

According to Hinze et al., construction sites are naturally complex and high-risk settings with numerous stakeholders, changing working conditions, and exposure to dangerous activities. (2013). Even with advancements in safety management systems, mishaps are still common. By 2023, the International Labour Organization (ILO) estimates that 30–40% of all workplace fatalities globally will be related to construction.

Understanding the underlying causes of incidents, maintaining legal compliance, and developing preventive measures all depend on accident investigation and reporting (Suraji et al. [2001]). Nonetheless, in many areas, including developing nations, the advancement of safer workplaces is impeded by a lackluster reporting culture, insufficient training, and a failure to fully utilize the results of investigations (Akinwale and Olusanya, 2016).

In order to improve safety performance, this paper examines accident investigation and reporting in the construction industry, stressing its significance, methods, difficulties, and consequences.

II. LITERATURE REVIEW

A. Accident Causation Theories

There are several models for explaining accidents at work:

➤ *The Domino Theory (Heinrich, 1931)*

The domino theory (Heinrich, 1931) accidents are the result of a chain of events, often triggered by dangerous behaviour.:

W. Herbert. Heinrich, who is frequently called the "father of safety," created the Domino Theory of Accident Causation in his book *Industrial Accident Prevention: A Scientific Approach* which was published in 1931. According to him, unsafe human behaviour accounts for 88% of accidents, unsafe environments for 10%, and uncontrollable circumstances (like natural disasters) for 2%.

Five dominoes standing in a row is the metaphor used by the model. A chain reaction is started when the first domino falls, which eventually results in an accident. The sequence shown by the dominoes is as follows.

- Ancestry and Social Environment: An employee's attitude toward safety is influenced by their upbringing, education, and surroundings.
- Fault of Person: Employees who possess unsafe characteristics like recklessness, carelessness, or ignorance are more likely to engage in risky behaviour.
- The direct cause of an accident is an unsafe act or condition (e.g. an employee not using personal protective equipment (PPE), working at heights without guardrails, or using faulty equipment etc.
- Accident: The actual incident, like falling, getting electrocuted, or getting hit by something.
- Injury: A negative outcome, like burns, fractures, or death.

➤ *The Fundamental Idea:*

The fundamental idea is that the chain reaction can be broken and the accident avoided if one domino in the sequence is eliminated, particularly the dangerous act or condition.

➤ *Criticism and Evolution:*

According to critics, Heinrich focused too much on "unsafe acts" (blaming employees) at the expense of organizational or systemic issues (such as a lackluster safety culture, insufficient training, or poor management).

Subsequent models, like Reason's Swiss Cheese Model, addressed these issues by emphasizing systemic flaws and latent organizational errors.

➤ *Relevance Today's world*

As a basis for research on accident causation, the Domino Theory is still significant. In the construction industry, it highlights how crucial it is to eliminate risky situations and

behaviours as soon as possible in order to stop accidents from getting worse and causing injuries. It is used in conjunction with systemic approaches in modern safety management to provide a more comprehensive understanding of accidents.

➤ *Swiss Cheese Model (Reason, 1990): Accidents occur when multiple system failures align, exposing latent organizational weaknesses.*

In his 1990 book *Human Error*, James Reason presented the Swiss Cheese Model of accident causation. One of the most popular frameworks for comprehending the causes of complex system failures is the model.

➤ *Core Concept*

When several defences, precautions, or barriers (like Swiss cheese slices) fail at the same time, accidents occur. Though each layer has "holes" (weaknesses), they are all intended to keep dangers from causing harm. Hazards can breach all defences and cause an accident when these holes line up. Key Components of the Model:

- The organizational and technical safeguards known as defensive layers (the slices of cheese) include regulations, safety training, protective gear, supervision, and inspection procedures.
- Weaknesses: The holes in the cheese stand for weaknesses in every layer. These may include: Active failures: Frontline workers' unsafe actions (e.g. G. disregarding safety procedures, not wearing PPE). Latent conditions: Organizational flaws that are not readily apparent (e.g. G. inadequate staffing, poor safety culture, inadequate training, and poor design).
- Accident Trajectory: Typically, several defences prevent hazards. However, an accident trajectory is produced if the holes in multiple layers line up, allowing hazards to get past all of the safety measures.

➤ *Practical Example in Construction (WORK AT HEIGHT):*

- Layer 1 (Policy): Scaffolding guardrails are required by safety regulations.
- Layer 2 (Supervision): The site manager verifies scaffold adherence.
- Layer 3 (Training): Employees receive harness usage training. Safety nets are put in place at Layer Layer4 (Equipment): Safety nets are installed.

If: The rule is out of date (then there is latent flaw), if the supervisor neglects to conduct an inspection (there is active failure), if workers disregard the use of PPEs for example, harnesses (there is active failure), and if safety nets are not properly installed and maintained (there is latent flaw). As a result, all the "holes" line up, a worker falls, and a serious injury happens.

One of the model's strengths is its recognition that accidents are rarely caused by a single person's error. Focuses on finding systemic flaws rather than placing blame on specific

people. Encourages businesses to strengthen their defences in order to lessen the likelihood of holes aligning.

➤ *Evolution and Criticism:*

According to critics, the model is static and fails to account for dynamic interactions in contemporary high-risk settings. Current methods of safety (e.g. G. Safety-II, resilience engineering) expand upon Reason's model by stressing system flexibility and adaptation.

➤ *Relevance in Today's world:*

The Swiss Cheese Model in the construction sector emphasizes:

- The necessity of several overlapping safety controls (regulation, technology, and training).
- Locating dormant organizational flaws and addressing them before they combine with human error.
- Fostering a culture of safety resilience as opposed to depending only on legal requirements.

These theories guide accident investigation frameworks in determining underlying causes that go beyond superficial mistakes.

➤ *Human Factors Models: Poor Supervision, Stress, Exhaustion, and Miscommunication are Important Factors (Gibb et al. (2006).*

Gibb, Hide, Haslam, and associates (2006) conducted a thorough investigation into construction accidents in the United Kingdom, particularly as part of the HSE research report RR156. Their research highlighted that human factors, not just technical malfunctions, are responsible for most construction accidents.

➤ *Three Primary Human Factor Levels were Used to Classify Accident Causation:*

- Immediate/Proximal Causes (Unsafe Acts and Conditions):
 - ✓ Employees' unsafe behaviours (e.g. employee using shortcuts, not donning PPE).
 - ✓ unsafe site circumstances (e.g. employee's inadequate maintenance, malfunctioning equipment).
 - ✓ These are the most obvious reasons, but they are frequently signs of more serious problems.
- Underlying/contributory factors:
 - ✓ Inadequate supervision, communication, or training.
 - ✓ Exhaustion, tension, or incompetence.
 - ✓ Inadequate risk assessment, sequencing, or planning.
- Root/Organizational Factors:
 - ✓ Management dedication and safety culture.
 - ✓ Inadequate use of resources for safety and health.
 - ✓ Inadequate oversight or adherence to regulations.

This model emphasizes how accidents are rarely the result of chance. A series of failures involving organizational, environmental, and human factors culminate in their emergence. The interaction of organizational influences, human limitations, and decision-making processes results in accidents, as explained by the Human Factors Model. It considers:

- Human error includes mistakes, infractions, slips, and lapses.
- Personal Factors: Health, fatigue, attitude, knowledge, and ability.
- Workload, time constraints, tools and equipment, and work design are all aspects of the job.
- Organizational elements include communication, policies, leadership, and resource distribution.
- Environmental elements include lighting, noise levels, weather, and workspace design.

Frequently combined with other theories of accident causation, such as Heinrich's Domino Theory or Reason's Swiss Cheese Model, this model demonstrates that accidents are multi-causative and avoidable through systemic controls.

Gibb and associates. (2006) emphasize that human, technical, and organizational factors interact in complex ways to cause construction accidents, which are not solely the result of worker negligence. In order to enhance accident investigation and reporting systems, these layers are identified and addressed with the aid of the Human Factor Model.

B. Reasons for Accident Investigation

Finding the immediate and underlying causes of accidents is one of the many goals of accident investigations.

- To identify corrective measures to prevent recurrence (Swuste et al. 2020).
- Ensuring adherence to regulations pertaining to occupational safety and health (OSH) (OSHA, 2022).
- Enhancing risk management procedures and organizational learning (Mohamed et al. 2009).
- Identifying immediate and underlying causes of accidents.

C. Construction Reporting Standards

A number of frameworks regulate the reporting of accidents in the construction sector.

- OSHA (USA) requires employers to report fatalities within eight hours and serious injuries within twenty-four hours.
- (OSHA, 2022). UK RIDDOR: Requires that accidents at work be reported systematically (HSE, 2021).
- Nigerian labour laws and the Factories Act offer guidelines, but they are not well enforced and have a poor safety culture (Akinwale and Olusanya, 2016).

III. METHODOLOGY

To examine accident investigation and reporting procedures in the construction industry, this study employs a qualitative review of the literature, case studies, and international safety guidelines. Trends and gaps are revealed by secondary data from national reports, OSHA, and the ILO (Lingard et al. (2017).

IV. ACCIDENT INVESTIGATION IN CONSTRUCTION

➤ *Steps in Accident Investigation:*

The following are the usual steps in an accident investigation:

- Fast Response: Ensure medical attention and keep the area safe. Suraji et al. [2001].
- Photographs, equipment inspections, and eyewitness reports are used to collect data.
- Employing instruments such as the "5 Whys," Fault Tree Analysis, or Fishbone Diagram (Reason, 1990) is known as root cause analysis.
- Documentation: Detailed summaries of the results.
- Suggestions for removing or managing risks are known as corrective measures (Mohamed et al. (2009).
- Monitoring the application of preventive measures is known as follow-up.

Ensuring the safety of construction sites requires having clear emergency protocols. The purpose of these protocols is to equip them with the necessary skills to manage any emergencies that may occur during construction projects. Construction workers can react quickly and effectively in an emergency, reducing the chance of fatalities or serious injuries, by having access to clear guidelines and protocols.

Recognizing and preparing for potential emergencies that might arise on a construction site is crucial. Natural disasters like earthquakes or extreme weather can be examples of these emergencies, as can mishaps like falls or equipment failures. Construction job site managers can create emergency plans that are specifically designed to handle each type of emergency by identifying these potential hazards.

When it comes to protecting employees' health during emergencies, first aid officers are essential. These officers are prepared to offer injured people emergency medical care until more qualified medical assistance can be obtained. Assessing the extent of injuries, providing first aid, and liaising with emergency services are some of their duties. Construction workers can receive timely and appropriate medical care, potentially saving lives, if there are trained first aid officers on the job site.

➤ *Role of Stakeholders*

Key stakeholders must work together to conduct an effective accident investigation.

- Employers: Must set up protocols and provide resources. (Hinze et al., 2013).
- Safety Officers: Investigation Teams are led by safety officers
- Workers: Take an honest part in reporting incidents.
- Regulators: Utilize inspections and sanctions to enforce adherence. (ILO, 2023).

V. REPORTING IN CONSTRUCTION

➤ *Importance of Reporting*

Reporting accidents improves accountability and transparency, generates data for trend analysis and predictive safety planning, and promotes an honest reporting culture by removing blame (Lingard et al. 2017; Swuste and associates. (2020). For several reasons, it is imperative that incident details, such as date, time, and location, be documented. It first aids in the investigation and analysis of the incident by offering a clear chronology of events. By using this information, it may be possible to pinpoint the underlying causes or contributing factors and implement focused interventions to stop future occurrences of the same kind.

Additionally, incidental data is a useful source of information for compliance and reporting needs. Organizations frequently have to notify insurance companies or regulators about incidents, and accurate reporting is ensured by the presence of thorough documentation. Finding any legal or compliance requirements that might result from an incident is also beneficial. Organizations can show their dedication to openness, responsibility, and ongoing enhancement of their incident management procedures by recording incident details.

Effective risk assessment and management is one of the main goals of incident reporting and response. We can determine the underlying causes of incidents and put precautions in place to lessen the risks by looking into them in great detail. By taking a proactive approach to risk, employers can protect workers' mental health and wellbeing, preserve a safe workplace, and stop similar incidents from happening again. To stay ahead of possible risks and guarantee everyone's continued safety through safe work practices, risk management strategies must be regularly reviewed and updated.

➤ *Challenges in Reporting*

One of the challenges people face when reporting accidents is

- The fear of being victimized or losing their job (Akinwale and Olusanya, 2016).
- Inadequate education and awareness.
- Insufficient enforcement and;
- Bureaucratic bottlenecks in developing countries. Umeokafor and associates. (2014).

➤ *Best Global Practices:*

Using digital reporting tools (online platforms, mobile apps) is one of the best reporting practices (Zhou et al. (2015).

Creation of channels for anonymous reporting in an effort to allay fears. Safety Management System (SMS) integration with reporting (Hinze et al. (2013).

Putting on awareness and training campaigns for managers and employees.

Giving injured workers first aid and medical attention right away is crucial in the event of a serious injury sustained during an incident. By attending to their medical and first aid requirements as soon as possible, we can lessen the incident's effects and guarantee our workers' wellbeing. Having trained individuals on hand who are capable of providing first aid and, if required, making arrangements for additional medical assistance is part of this. Prioritizing the health and safety of our employees not only shows that we care about their mental health and wellbeing, but it also promotes a supportive and caring work environment.

Coordinating a successful incident response requires effective communication. Clear channels of communication must be established between all stakeholders, including staff, management, and emergency services, if necessary. Accurate and timely information exchange guarantees that everyone is in agreement and able to act accordingly. Good communication also aids in handling the fallout from an incident, such as updating staff on ongoing investigations or alerting them to any changes in protocols.

VI. CASE EXAMPLES

- Case 1: Qatar World Cup Construction Projects – Implementation of strict reporting protocols significantly reduced fatal accidents (Amnesty International, 2021).
- Case 2: Nigerian Construction Industry – Underreporting remains prevalent, with many accidents settled informally without documentation (Akinwale & Olusanya, 2016).

VII. DISCUSSION

Reporting and investigating accidents are crucial for proactive risk management and are not just compliance tools. There are fewer accidents, lower expenses, and better reputations for construction companies that invest in appropriate investigation techniques and prioritize transparent reporting systems (Gibb et al. 2006; Lingard and associates. 2017). However, in order to promote an open reporting culture, institutional and cultural barriers need to be addressed (Umeokafor et al. (2014).

On construction sites, incident reporting is essential for spotting and resolving possible risks, averting mishaps, illness, and injury, and fostering a safety culture.

Employees are taught the value of reporting incidents during construction induction training. This training places a strong emphasis on the necessity of reporting any incidents, near misses, or hazardous situations that employees come across at work as soon as possible. By reporting these incidents, employees help ensure everyone on the construction site is safe and help stop future occurrences of the same kind.

VIII. CONCLUSION

An essential component of construction workplace safety is the investigation and reporting of accidents. They promote organizational learning and continuous improvement in addition to identifying causes. It is imperative that the construction sector shift from a reactive to a proactive safety culture that prioritizes transparency and responsibility.

RECOMMENDATIONS

- In developing countries like Nigeria,
- Enforce reporting standards more strictly.
- Invest in the education of safety officers and accident investigators.
- Present real-time, digital reporting tools to encourage truthful reporting, cultivate a culture of no-blame.
- Create platforms for exchanging knowledge across industries to share lessons learned.

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